DISSERTATION DOSSIER
TABLE OF CONTENTS

Chapter 1:	**Academic Curriculum Vitae** **Plan of Doctoral Program Study** **Transcript**	**Tab 1**
Chapter 2:	**Official Forms**	**Tab 2**
	Form C: Request for Appointment of Dissertation Chairperson **Form D: Request for Appointment of Dissertation Advisory Committee** **Form E: Report of Proposal Defense Examination for the Doctor of Philosophy Degree** **Form F(a): Request for Dissertation Defense Date for the Doctor of Philosophy Degree** **Form H(a): Report of Dissertation Defense for the Doctor of Philosophy Degree** **Form L: Verification of Completion of Qualifying Examination**	
Chapter 3:	**Linking Paper/Executive Summary**	**Tab 3**
Chapter 4:	**Manuscript 1: Manuscript of Excellence**	**Tab 4**
	USUHS Manuscript Approval or Clearance Document **Proof of Submission to *Journal of Nursing Scholarship*** **"The Unique Population of Military Service Members and Informed Consent"**	
Chapter 5:	**Dissertation Proposal**	**Tab 5**
	Dissertation Proposal **Dissertation Proposal Defense Slides** **USUHS IRB Exemption of Study Documents**	
Chapter 6:	**Manuscript 2: State of the Science``` `**	**Tab 6**
	USUHS Manuscript Approval or Clearance Document **Proof of Submission to *Military Medicine*** **"Body Mass Index and Physical Activity in the Military Environment"**	
Chapter 7	**Manuscript 3: Data Analysis**	**Tab 7**
	USUHS Manuscript Approval or Clearance Document **Proof of Submission to *Military Medicine***	

"The Relationship between Body Mass Index and Vigorous Physical Activity in a Military Population"

Chapter 8 **Manuscript 4: Data Analysis** **Tab 8**

USUHS Manuscript Approval or Clearance Document
Proof of Submission to *Applied Nursing Research*
"Access to Health Care, Body Mass Index and Vigorous Physical Activity in a U.S. Adult (ages 20-45) Population"

Chapter 9 **Manuscript 5: Data Analysis** **Tab 9**

USUHS Manuscript Approval or Clearance Document
Abstract Approved for Submission (Presubmission inquiry)
Proof of Submission to *American Journal of Health Promotion*
"Environmental Influences on Body Mass Index and Vigorous Physical Activity in Two U.S. Adult (ages 20-45) Samples"

Chapter 10 **Abstract** **Tab 10**

Karen A. Rieder Research/Federal Nursing Poster Session (Proof of Submission)
"The Relationship between Body Mass Index and Vigorous Physical Activity in an Active Duty Military Population" [Abstract]
Poster submitted

Chapter 11 **Dissertation Defense Presentation** **Tab 11**

Dissertation Defense Presentation Slides

Chapter 12 **Supporting Documentation** **Tab 12**

Oral Presentation: USUHS Research Week 2008
Poster Presentation: USUHS Research Week 2008
"The Relationship between Body Mass Index and Vigorous Physical Activity in an Active Duty Military Population"
USUHS Notice of Intramural Funding
Qualifying Comprehensive Examination

CURRICULUM VITAE

Julie M. Bosch, Lt Col, USAF, NC

4461 Turnberry Place
Niceville, Florida 32578
Home Phone: 410-535-2981
Mobile Phone: 443-624-5212
Email: julie.bosch@eglin.af.mil

Education:

Year	Degree	Institution/Location
2008	Doctor of Philosophy in Nursing Science	Uniformed Services University Bethesda, Maryland
2000	Master of Science in Nursing **Concentration**: Family Nurse Practitioner	Uniformed Services University Bethesda, Maryland
1986	Bachelor of Science in Nursing	Pennsylvania State University University Park, PA

Professional Experience:

Year	Position title/Institution/Duty Station/Location	Scope of Role
2008-Present	**Director, Clinical Research,** 96th Medical Group Eglin AFB Florida	Directs Clinical Research activities within the 96th Medical Group and has primary authority, responsibility, and accountability for research standards and adherence to defined research protocols. Evaluates and establishes program of clinical research to advance health status of active-duty and military beneficiaries.
2005 to 2008	**Air Force Institute of Technology, Doctoral Student and Candidate**, Graduate School of Nursing (GSN), Uniformed Services University of the Health Sciences, Bethesda, Maryland	Responsible for excelling in five areas of concentration: nursing knowledge, research methods, statistics and design, cognates, federal and military healthcare policy and issues, and the dissertation.
2003 to 2005	**Element Leader and Family Nurse**	Leads team of 10 healthcare and 30

Year	Position title/Institution/Duty Station/Location	Scope of Role
	Practitioner, 437th Medical Operations Squadron, Charleston Air Force Base, South Carolina	support staff. As a Primary Care Manager, responsible for healthcare of 1,600+ enrolled beneficiaries. Independently performs medical assessments, treatment of diseases/injuries, health promotion, education, and prevention for well/sick individuals from birth to old age. Selected as first-ever FNP on high-profile humanitarian mission to Guatemala.
2000-2003	**Family Nurse Practitioner/Element Chief,** 1st Medical Operations Squadron, Langley Air Force Base, Virginia	Primary Care Optimization training cadre. Orders and interprets lab/radiological tests. Prescribes drugs/medical treatments.
1998 to 2000	**Air Force Institute of Technology, Family Nurse Practitioner student,** Uniformed Services University, Graduate School of Nursing, Bethesda, Maryland	Completed 52 semester hours with 3.64/4.00 cumulative GPA. Completed 720+ clinical hours in a primary care setting. And defended research thesis.
1995-1998	**Nurse Manager, Family Practice Clinic**, 22nd Medical Operations Squadron, McConnell Air Force Base, Kansas	Mentored and supervised 14 clinic personnel. Coordinates nursing care in family practice and immunization clinics. Advises flight commander on nursing issues/practices. Ensures adequate nursing staffing within flight. Applies clinical expertise as triage/advice nurse. Keeps Air Force-wide nursing initiatives current.
1993-1995	**Staff Nurse, Hemodialysis Unit**, 59th Medical Wing, Lackland Air Force Base, Texas	Responsible for supervision of 5 dialysis technicians. Provides care to patients undergoing acute and chronic hemodialysis, peritoneal dialysis, hemofiltration, and pediatric and /neonate renal replacement therapy. Directs pre- and end-stage renal disease patient/family education program.

Year	Position title/Institution/Duty Station/Location	Scope of Role
1991-Present	**Active Duty Nurse**, United States Air Force	
1990-1991	**General Rehabilitation Services**, Baltimore, Maryland	Responsible for case management of occupational injured workers. Coordinated medical care and rehabilitation with multidisciplinary team.
1989 - 1990	**Public Health Nurse,** Youngstown, Ohio	Responsible for community health outreach programs, including pediatric wellness clinics, sexually transmitted disease education, and health promotion education.
1988 - 1989	**Cardiac Care Nurse,** Warren, Ohio	Provided patient care to critically ill patients. Completed Advanced Cardiac Life Support Course.
1987 – 1989	**Nurse Consultant**, Ohio and Pennsylvania	Created a continuing education course regarding AIDS Education for Nurses. Facilitated and relayed questions and concerns regarding the care of the HIV positive patient within the eastern Ohio and western Pennsylvania region. Educated groups of registered nurses in hospitals and nursing homes.
1986-1987	**Charge Nurse,** George Washington University Medical Center, Washington, DC	Responsible for the supervision of 10 staff. Provided patient care to critically ill medical patients with renal disease and HIV infection.

Licensure:

Source/Type	Number
Maryland Board of Nursing: RN	R106899

Source/Type	Number
American Nurses Credentialing Center FNP-BC	348790

Honors and Awards:

Year	Award Title	Presented By
2005-2008	Full time Air Force Institute of Technology Scholarship Recipient Doctoral Degree	Uniformed Services University of the Health Sciences Graduate School of Nursing
2006	Outstanding First Year Air Force Doctoral Student of the Year	Uniformed Services University of the Health Sciences Graduate School of Nursing
2005	Air Force Meritorious Service Medal with one oak leaf cluster	United States Air Force
2003	Field Grade Officer Nurse of the Year	Langley Air Force Base, Virginia
2002	Field Grade Officer of the Quarter	Langley Air Force Base, Virginia
2000	Air Force Meritorious Service Medal	United States Air Force
1998-2000	Full time Air Force Institute of Technology Scholarship Recipient Master of Science in Nursing Degree	Uniformed Services University of the Health Sciences Graduate School of Nursing
1998	Air Force Commendation Service Medal with one oak leaf cluster	United States Air Force
1996	Company Grade Officer of the Year	McConnell Air Force Base, Kansas
1996	Company Grade Officer of the Quarter	McConnell Air Force Base, Kansas
1991	Defense Meritorious Service Medal	Department of Defense
1991	Outstanding Unit Award	Department of Defense

Education – Non-Degree Granting:

Date	Course Title
April 2008	SPSS Intermediate Web-Based Training
Jan 2008	Exercise Specialist Workshop, American College of Sports Medicine
Dec 2007	SPSS Basics Web-Based Training
Aug 2007	TriService Nursing Research Program Grant Writing Camp, Phase II, San Diego, CA
Aug 2007	Air Force Annual Medical Research Symposium, Crystal City, Virginia
May 2007	TriService Nursing Research Program Grant Writing Camp, Phase I, Bethesda Maryland
Nov 2006	Public Responsibility in Medicine and Research (PRIM&R), Annual National Conference

Publications:

In Review

Bosch, J. M., Padden, D, & Bibb, S. C**.** The relationship between body mass index and vigorous physical activity in a military population. (Submitted)

Research Activities/Projects/Funding:

Date	Title of Activity/Project/Position	Funding
Submitted 10/07	**Principal Investigator:** Epidemiological Factors Associated with Increased Body Mass Index in Active Duty Military Engaged in Vigorous Physical Activity. The purpose of this proposed descriptive, comparative study is to examine the relationship between body mass index and vigorous physical activity in two U.S. Adult (ages 20-45) Samples	Funded Intramural USUHS $2,500

Presentations:

National/International

Nov 2008	Karen A. Rieder Nursing Research Poster Session: The Relationship between Body Mass Index and Vigorous Physical Activity in an Active Duty Military Population, San Antonio Texas (Abstract submitted)

Local/Regional

Feb 2009	Florida Magnet Nursing Research Conference (6th Annual). "Access to Health Care, Body Mass Index and Vigorous Physical Activity in a US Adult (ages 20-45) Population" (Poster presentation)
May 2008	Uniformed Services University Research Symposium. "The Relationship between Body Mass Index and Vigorous Physical Activity in an Active Duty Military Population (Poster presentation)
May 2008	Uniformed Services University Research Symposium. "The Relationship between Body Mass Index and Vigorous Physical Activity in an Active Duty Military Population (Podium presentation)

Teaching Experience:

GRADUATE SCHOOL OF NURSING, UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES

Graduate Courses

Date	**Course No**.	**Title/Course Level**
Spring 2007	PHD	Integration and Application of Family Theory in Primary Care (14 FNP students, Masters Level) * Teaching Assistant

Guest Lectures

Date	**Course No**	**Title/Topic/Course Level**
June 2007		Uniformed Services University of the Health Sciences Family Nurse Practitioner Health Assessment Simulation Center ** Invited Instructor

Academic/Service Activities:

Date	**Title (Chair/Member)**	**Service/Committee**
Jan 2009	Government Observer	TriService Nursing Research Program Scientific Review Panel

2006-2008	Alternate Member	Walter Reed Army Institute of Research, Silver Spring, MD

Membership in Professional Organizations:

Date	Organization
2007-Present	Association of Military Surgeons of the United States
2005- 2008	Secretary, PhD Student Advisory Council, USUHS
2005-2006	Membership Committee, Tau Theta Chapter, Sigma Theta Tau
2000-Present	Sigma Theta Tau, National Nurses Honor Society

Uniformed Services University of the Health Sciences
Graduate School of Nursing
Request for Appointment of Dissertation Chairperson (Form C)

Name of Student: Julie M. Bosch, Maj, USAF, NC

Semester: Summer 2007 Area of Concentration: Epidemiological Factors and Increased Body Mass Index in Military Members

Name of Selected Dissertation Chairperson: Sandra Garmon Bibb, DNSc, RN

Phone Number:301-787-4955

The above named student has selected the named faculty member to serve as Dissertation Chairperson.

The undersigned faculty member agrees to serve as the Dissertation Chairperson, understanding all responsibilities that are part of this critical role:

Sandra Garmon-Bibb, DNSc, RN
Printed Name

Sandra C. Bibb
Signature

Julie M. Bosch, Maj, USAF, NC
Printed Name of Student

Julie M Bosch
Signature

(Approval)/Disapproval

Signature: Karen Elberson Date: 30 May 07
Karen Elberson RN, PhD
Director, Doctoral Program

(Approval)/Disapproval

Signature: William T. Bester Date: 24 May 07
William T. Bester, RN, MSN, CNAA, BC
Brigadier General (Ret)
Acting Dean, Graduate School of Nursing, USUHS

Uniformed Services University of the Health Sciences
Graduate School of Nursing
Request for Appointment of Dissertation Advisory Committee (Form D)

Name of Student: Julie M. Bosch, Maj, USAF, NC

Semester: Summer 2007 Area of Concentration: Epidemiological factors and increased body mass index in active duty military population
Dissertation Chairperson: Sandra Garmon Bibb, DNSc, RN

Selected Faculty to Serve as Dissertation Advisory Committee:

1. Diane Padden, Ph.D. Phone # 301-295-2989
2. Tracy Sbrocco, Ph.D. Phone # 301-295-9674

The above named student has selected the named faculty members to serve as the Dissertation Advisory Committee.

The undersigned faculty members agree to serve as the Dissertation Advisory Committee, understanding all responsibilities that are part of this critical role:

Diane Padden, Ph.D. — Diane Padden
Printed Name of Faculty Member — Signature

Tracy Sbrocco, Ph.D. — [signature]
Printed Name of Faculty Member — Signature

Julie M. Bosch, Maj, USAF, NC — Julie M. Bosch, Maj.
Printed Name of Student — Signature

(Approval)/Disapproval

Signature: Karen L. Elberson — Date: 17 May 2007
Karen Elberson RN, PhD
Director, Doctoral Program

(Approval)/Disapproval

Signature: [signature] — Date: 22 May 07
William T. Bester, RN, MSN, CNAA, BC
Brigadier General (Ret)
Acting Dean, Graduate School of Nursing, USUHS

17#01

Uniformed Services University of the Health Sciences
Graduate School of Nursing
Report of Proposal Defense Examination
for the Doctor of Philosophy Degree (Form E)

The proposal defense of Julie M. Bosch, Maj, USAF, NC,

entitled: Epidemiological Factors Related to Increased Body Mass Index in Active Duty Military Engaged in Vigorous Physical Activity was held

on October 11, 2007 from 11:00 to 12:00. The decision of the Examining Committee is:

PASS
A. Both the proposal and the oral explanation are satisfactory: ____

B. Minor changes are recommended by the Dissertation Advisory Committee and are to be made to the satisfaction of the Dissertation Chairperson: X

DEFER
A. Minor changes in the proposal are required. Changes must be made to the satisfaction of the Dissertation Chairperson: ____

B. Major changes are required. Changes must be made to the satisfaction of the Dissertation Advisory Committee: ____

C. Remediation required prior to making major changes. Completion of remediation must meet the satisfaction of the Dissertation Advisory Committee: ____

FAIL
Neither the oral performance nor the proposal is adequate: ____

Signatures of the Committee

Chairperson: Sandra C. Bass

Member: Diane L Padden

Member: Dina Brown

Approval/Disapproval

Signature: Christine Kasper, RN, PhD
Director, Doctoral Program

Date: 10/12/07

Approval/Disapproval

Signature: William T. Bester, RN, MSN, CNAA, BC
Brigadier General (Ret)
Acting Dean, Graduate School of Nursing, USUHS

Date: 10/12/07

Uniformed Services University of the Health Sciences
Graduate School of Nursing
PhD Program
Request for Dissertation Defense Date for the
Doctor of Philosophy Degree (Form F_A)

Name of Student: Julie M. Bosch, Lt Col, USAF, NC

Request for doctoral dissertation defense date of the student named above: 21 July 2008

The title of the dissertation is: Epidemiological Factors Associated with Increased Body Mass Index in Active Duty Military Engaged in Vigorous Physical Activity

The Majority of the Dissertation Advisory Committee Members are available on this date:

Signature, Chairperson — Sandra C. Bibb, DNSc, RN — (Yes) or No
Printed Name

Signature, Committee Member — Diane Padden, PhD, CRNP — (Yes) or No
Printed Name

Signature, Committee Member — Tracy Sbrocco, PhD — (Yes) or No
Printed Name

Signature, Committee Member — _____ — Yes or No
Printed Name

(Approval)/Disapproval

Signature: _____ Date: 2-14-08
Director, Doctoral Program

Approval/Disapproval

Signature: _____ Date: _____
Dean, Graduate School of Nursing, USUHS

Form F_A: Applicable to PhD Students Records from Inaugural to 2006 Entry Class
Supports Doctoral Handbook Policies Prior to the 2007 Handbook

Uniformed Services University of the Health Sciences
Graduate School of Nursing

Report of Dissertation Defense for the Doctor of Philosophy Degree (Form H)

Title of the dissertation: Epidemiological Factors Associated with Increased Body Mass Index in Active Duty Military Engaged in Vigorous Physical Activity

The decision of the Dissertation Committee is:

PASS
A. Both the dissertation and the oral defense are satisfactory: X
B. Minor changes are recommended by the Dissertation Advisory Committee that are to be made to the satisfaction of the Dissertation Chairperson: _____

DEFER
A. Major changes in the dissertation are required. Changes must be made to the satisfaction of the Dissertation Chairperson: _____
B. Major changes in the dissertation are required. Changes must be made to the satisfaction of the Dissertation Advisory Committee and at that time the oral defense will be rescheduled: _____

FAIL
Neither the oral performance nor the dissertation are adequate: _____

Signatures of the Committee
Chairperson: Sandra C BSS 7/21/08
Member: [signature] 7/21/08
Member: Diane Padden 7/21/08
Member: _____

Approval/Disapproval
Signature: _____ Date: 7/29/08
Director, Doctoral Program

Approval/Disapproval
Signature: [signature] Date: 7-31-08
Dean, Graduate School of Nursing, USUHS

Uniformed Services University of the Health Sciences
Graduate School of Nursing
PhD Program
Verification of Completion of
Qualifying Examination
Form L

Verification of Submission of Qualifying Examination

Date: 3/18/07

Dissertation Chairperson: Sandra C. Bass **Date:** 3/18/07

Verification of PhD Student Passing Qualifying Examination

Date: 4/18/07

Dissertation Chairperson: Sandra C. Bass **Date:** 4/18/07

(The verifications above can be notification by
Email or Other Written Communication)

Verification of Successful Completion of Qualifying Examination

Attach Policy Statement from Appropriate Class Year in Handbook Regarding
Requirement of Passing Grade on Qualifying Examination
Prior to Dissertation Proposal Defense

Form E: Report of Proposal Defense Examination To Be Attached

Form L: Applicable to PhD Students Records from Inaugural to 2006 Entry Class
Supports Doctoral Handbook Policies Prior to the 2007 Handbook

Executive Summary

The World Health Organization (WHO) recently described "globesity" as a global epidemic affecting 300 million people worldwide (WHO, 2004). U.S. adults, as well as military service members are not meeting the Healthy People 2010 '*healthy weight'* objective that '60% of adults will have a healthy weight'. Questions arise related to the influence of American cultural norms on military members, as compared to the intended influence of military cultural values, beliefs, and practices. The impact of failing to meet a national health goal has major health implications, since adults who are overweight and obese are at increased risk for disease co-morbidities such as hypertension, diabetes, and hyperlipidemia.

Therefore, a study was conducted using preexisting data from the 2005 Behavioral Risk Factor Surveillance System (BRFSS) and 2005 Survey of Health Related Behavior among Military Personnel (SHRB). The purpose was to compare the influence of epidemiological factors on body mass index (BMI) and vigorous physical activity (PA) in two samples of U.S. adults. An epidemiological triad model framed this study allowing the research focus to shift away from the traditional biomedical paradigm and encompass a broader view that includes environmental influences.

Secondary data analysis (SDA) and a descriptive comparative design were used. Over 900 variables, data files, codebooks and questionnaires from both data sets were reviewed. Two sample subsets were created and participants were restricted to the ages of 20 through 45 years of age. The final sample for the BRFSS was N = 131,377 and for the SHRB, N = 14,852.

Foundational to all research studies, is informed consent, which was the topic of the manuscript of excellence titled *The Unique Population of Military Service Members and Informed Consent.* The purpose of this article was to explore similarities between the military

population and other vulnerable populations regarding the risk of coercion. The three ethical principles, beneficence, justice and respect for persons were reviewed in a framework of the military organization.

The second manuscript was *Body Mass Index and Physical Activity in the Unique Military Environment.* The purpose of this article was to lay the foundation for future research by presenting a review of the literature about body mass index, vigorous PA, and an overview of the unique military environment. Unique military aspects were identified as 1) mandatory physical fitness standards, 2) deployment readiness, and 3) access to health care.

The third manuscript was titled *The Relationship between Body Mass Index and Vigorous Physical Activity in a Military Population.* Data were analyzed from the SHRB sample and one-way ANOVA analysis revealed no statistically significant differences ($p = .901$) between mean BMI and three different levels of vigorous PA groups (met vigorous PA recommendations, insufficient vigorous PA to meet recommendations, and no vigorous PA). However, there was a significant difference in BMI means between the group that 'passed their most recent physical fitness test' and those who did not ($p = .000$). Mandatory physical fitness standards are one unique component of the military environment that may positively impact service members' BMI.

The title of the fourth manuscript was *Access to Health Care, Body Mass Index and Vigorous Physical Activity in a U.S. Adult Population.* The 2005 BRFSS sample data set was analyzed and there was a significant difference ($p = .000$) between mean BMI among the three vigorous PA groups. Healthy People 2010 'access to care' objectives were compared to the study results and the national goal of '100% health care coverage' was not met. Only 81% of the

sample reported health care coverage. BMI was significantly lower in those who stated they had health care, versus those who did not ($p = .000$).

The final manuscript was *Environmental Influences on Body Mass Index and Vigorous Physical Activity in Two U.S. Adult Samples.* The purpose was to describe unique environmental factors (deployment readiness and access to care) and explore their relationship to BMI and vigorous PA. Variables extracted were age, gender, race/ethnicity, BMI, branch of service (SHRB), veteran status (BRFSS), vigorous PA, deployment frequency, and access to care. Results of analyses for both samples' were compared to HP 2010 Leading Health Indicators: 1) Overweight or obese, 2) Physical Activity and 3) Access to Health Care. The BRFSS sample did not meet the healthy weight objective or the access to health care objective, but did meet the vigorous PA objective. The SHRB sample met the vigorous PA and access to health care objective, but did not meet the healthy weight objective. The lowest mean BMI in the deployment group was the group who had 'not deployed in the past three years' and the highest mean BMI was the group who 'deployed three times in the past three years' ($p = .000$).

Overall, the data analysis for this dissertation had limitations that included statistical significance inflation due to large sample size. The importance of calculating effect size and Cohen's *d* was valuable and extremely relevant since these measurements are independent of sample size. Bias is inherent to self-report measurement of body weight and height, however according to the literature; results most likely underestimated the obesity prevalence. Another limitation was the size and demographic differences of the two sample groups, therefore, direct statistical comparisons between the two groups was avoided.

The results of this dissertation research study illustrated that the military is now a stakeholder in the worsening public health issue of increasing weight in the U.S. population.

Although, military members exist in a unique culture of mandatory fitness standards, deployment readiness, and access to health care, they may not be protected from the overweight trend in the U.S. Service members emerge from family cultures, live in American culture, but work in a military culture. Obesity experts agree that unless future studies develop strategies to change the U.S. obesogenic environment, it is likely the obesity and overweight epidemic will continue unabated in both the military and the non-military environments.

Uniformed Services University
of the Health Sciences

Manuscript Approval or Clearance*

INITIATOR

USU Principal Author: Julie M. Bosch, Major, USAF, NC

1. Academic Title: Maj Bosch-PhD candidate in the Graduate School of Nursing, Family Nurse Practitioner,
2. School/Department: USUHS, Graduate School of Nursing
3. Phone: (301)-295-9004
4. Type of Publication (submitted to): Paper Article ✓ Book Chapter
   USU WWW Home Page at (location): None
   Other: None
5. Manuscript title: The Unique Research Population of Military Service Members and Informed Consent
6. Intended publication (include organization if appropriate): *Journal of Nursing Scholarship*
7. Required by (publication receipt) date: 15 March 2008
8. Date submitted for USU approval: 21 February 2008

CHAIR OR DEPARTMENT HEAD APPROVAL

1. Name: Sandra Garmon-Bibb, DNSc, RN
2. School/Department: USUHS, Graduate School of Nursing
3. Date: 2/28/08
4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).
   ***Note:** *It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*
5. ☑ Chair / Department Head Approval

Sandra C. Bibb 2/28/08 3/6/08

Chair / Department Head Approval/Date

(If approval or clearance is required, see other side of form)

DEAN APPROVAL

USUHS Form 5230 (VAM) 10/99

2-28-08

1. Name: Bruce A. Schoneboom, CRNA, PhD COL, AN, Acting Dean, GSN
2. School/Department: USUHS, Graduate School of Nursing
3. Date: _____
4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).
   ***Note:** *It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*
5. ☑ Dean Approval

Dean Signature/Date

OUA APPROVAL

1. Name: _____
2. Date: _____
3. ☐ USU Approved or
   ☐ DoD approval/clearance required
4. ☐ Submitted to DoD (Health Affairs) on (date): _____
   or
   ☐ Submitted to DoD (Public Affairs) on (date): _____
5. DoD approved/cleared (as written) or ☐ DoD approved/cleared (with changes)
6. DoD clearance/date: _____
7. DoD disapproval/date: _____

Director, OUA Signature/Date

JOURNAL OF NURSING SCHOLARSHIP

Submission Confirmation

Thank you for submitting your manuscript to *Journal of Nursing Scholarship*.

Manuscript ID:	JNU-03-08-072
Title:	The Unique Population of Military Service Members and Informed Consent
Authors:	Bosch, Julie Bibb, Sandra
Date Submitted:	10-Mar-2008

Print Return to Dashboard

November 7, 2007

Karen Roush, RN, MSN, FNP
Editorial Director, *American Journal of Nursing*
333 Seventh Avenue, 19th floor
New York, NY 10001

Dear Ms. Roush,

Thank you for your interest in our manuscript about informed consent for military research subjects and vulnerable populations. As you mentioned, even though it engages the reader in a theoretical discussion about the unique military population, there is an interest to a wider non-military nursing audience.

I am enclosing our submission to *AJN* entitled, "The Unique Research Population of Military Service Members and Informed Consent" and the word count is what you had recommended, (2100-2800 words). There are no submissions or previous publications that duplicate any part of this manuscript and there is no mention of specific names or locations. The views expressed in this article are the authors and not those of the Uniformed Services University, the Air Force, or the Department of Defense.

I will be serving as the corresponding author for this manuscript. My co-author, Dr. Sandra Bibb, is my doctoral dissertation committee chair and my PhD program advisor. I assume responsibility for keeping her informed of our progress through the editorial review process, the content of the reviews, and any revisions made.

Again, I thank you for your support and positive feedback. I look forward to working with you and the *AJN* staff.

Sincerely,

Julie M. Bosch, Maj, USAF, NC, PhD (c)
PhD Candidate/Family Nurse Practitioner
Uniformed Services University of the Health Sciences
Graduate School of Nursing
4301 Jones Bridge Road
Bethesda, MD 20814
443-624-5212 (cell)
jbosch@usuhs.mil

The Unique Research Population of Military Service Members and Informed Consent

Manuscript Authors:

Corresponding Author: Julie M. Bosch, Maj, USAF, NC, PhD (c)
Graduate School of Nursing
Uniformed Services University of the Health Sciences
Bethesda, MD 20814
E-mail: jbosch@usuhs.mil

Sandra C. Bibb, DNSc, RN
CAPT (ret), USN, NC
Associate Professor
Chair, Department of Health Systems, Risk, and Contingency Management
Graduate School of Nursing
Uniformed Services University of the Health Sciences
Bethesda, MD 20814

Author Note

Military Disclosure:

"The views expressed are those of the authors and do not reflect the official policy or position of the Uniformed Services University of the Health Sciences, the Department of the Defense, or the United States government."

Grant Support:

This article was completed in partial fulfillment of the requirements for the Doctor of Philosophy in Nursing Science Degree at the Uniformed Services University of the Health Sciences in Bethesda, Maryland. The doctoral program was funded by a scholarship from the U.S. Air Force Nurse Corps.

Abstract

Informed consent is foundational to every research study and requires dedicated communication between the researcher and the research subject. The history of informed consent, examples of inadequate consent, and a review of the optimal consent process are reviewed. There are certain populations considered particularly vulnerable and at-risk for coercion to participate in research studies. Some of these potential research subjects are prisoners, mentally disabled persons, economically disadvantaged persons, and children. Military service members are not "officially" recognized as a vulnerable population, but may be placed in situations where their risk of coercion is increased. When military members consent to serve in the military, consent to participate in research studies is not automatic. The purpose of this article is to explore similarities between the military service member population and other vulnerable populations regarding informed consent and the risk of coercion.

Introduction

Informed consent is foundational to any research study and requires dedicated communication between the researcher and the research subject. Informed consent is a process, and not merely a single event. Informing is the transmission of the research ideas and essential content from the researcher to the potential subject(s); and consent is the potential subject's agreement to participate in a research study (Burns & Grove, 2005). Although signing of the consent form is a tangible and visible act, the process begins with recruitment and continues through the course of a research study (Paul, 2007). Therefore, initiating the process of written informed consent from human subjects prior to beginning research is both essential and ethical. Without informed consent, the research study is in peril, ethical principles violated and the rights of human subjects are unprotected.

There are certain populations considered particularly vulnerable and at-risk for undue coercion to participate in research studies. Some of these vulnerable potential research subjects are prisoners, pregnant women, mentally disabled persons, economically disadvantaged persons, and children. Vulnerable persons are considered less able to defend themselves than others in a given situation (Rose & Pietri, 2002). Additional safeguards must be put into place during conduction of the research studies to protect the rights and welfare of these populations. Like other vulnerable populations, military service members may be

at risk of undue coercion to participate in research studies. Military members are not "officially" recognized as a vulnerable population, but may be placed in situations where they may not feel free to defend themselves in relation to participation in research studies.

Service members are obligated to obey direct and lawful orders from superiors or face the possibility of judicial punishment in the military court system. Even though participation in research is not subject to direction or judicial punishment for refusal, the very nature of military rank and organizational structure may add to feelings of coercion or pressure to enroll in research studies if they are conducted or coordinated by senior officials. This unique superior-subordinate relationship in the military necessitates special protection to avoid coercion or undue influence on a military research participant (McManus, Mehta, McClinton, DeLorenzo, & Baskin, 2005). The purpose of this article is to explore similarities between the military service member population and other vulnerable populations regarding informed consent.

Historical perspective

During the first half of the twentieth century, prisoners were used in place of laboratory animals to test cosmetic toxicity. The Atomic Energy Commission irradiated prisoners in their earlier experiments, causing sterility and severe burns in these subjects (Kiefer, 2007). This exploitation of prisoners was addressed in 1978, when the Department of Health and Human Services (DHHS)

acknowledged that prisoners are under unique constraints affecting their true voluntary decision to participate in research. Additional protections were put into place for the protection of prisoners and today this group is no longer used as a population of convenience. Currently, the only research conducted with prisoners is that which actually impacts their quality of life. The philosopher Carl Cohen argued, research outside of prisons might have coercive risk as well; therefore to the degree that coercion is involved, "feeling coerced" may have little to do with actual imprisonment (Lerner, 2007).

Conducting research with children also poses a unique challenge. The *risks* of such research must be balanced carefully with the anticipated *benefits* of the research. Children are considered a vulnerable population because they are not autonomous and do not yet have cognitive ability equal to that of an adult (Parvizi, Tarity, Conner, & Smith, 2007). In the Willowbrook hepatitis studies, institutionalized children were purposefully injected with hepatitis in the quest for an effective vaccine (Blustein, 2007). The institutional review board scrutinizes the parameters of allowable risk more closely when children are research subjects. The basic consent model with children is that parents provide permission for the child to participate in research and children also provide their assent. However, the absence of dissent should not be misinterpreted as assent (Hicks, 2007).

Consider another group that is also considered vulnerable, that of a *worker,* or the employee of an organization. The infamous Tuskegee syphilis

study began in 1932 and sadly continued for 40 years, using itinerant black farm workers to determine the effects of untreated syphilis. These men were lied to about their condition and not given standard therapy (Blustein, 2007). Research studies are routinely conducted in the workplace, and include educational institutions, power plants, aircraft cabins, or military settings (Rose & Pietri, 2002). Employees of organizations may experience or perceive undue pressure from supervisors to participate in research or to respond to a study in such a way that is deemed advantageous to the organization. Since the military is a unique work institution with a unique chain of command structure, military members, like *workers* or employees of an organization, may fear reprisal from leaders if they decline to participate in research studies or surveys when solicited.

Early controversies surrounding the protection of military research subjects arose from questions regarding service members' autonomy. An autonomous person is an individual who is capable of the deliberation of personal goals and who acts under their own direction (Levine, 1986). General George Washington, in the 1700s, had scabs from the lesions of people who were recovering from small pox infection scratched into the skin of his soldiers. This action resulted in mild disease, but ensured the troops' small pox protection and reduced risk for a future pox epidemic. Numerous soldiers died as a result of this tactic; however George Washington's Army won the War for Independence. Fortunately this mentality changed through the years. In 1990, Major Walter

Reed used American soldiers to document the mode of yellow fever transmission in Havana, Cuba. Reed drew up a contract and outlined the risks and benefits of the study. Although, it was not a requirement to obtain written consent during this time, the ensuing Yellow Fever Commission was regarded as the first to use consent documentation (McManus, et al, 2005). The military has made huge advances this past century regarding informed consent, but military members may still need additional protection, similar to those of vulnerable populations.

In a real scenario, general military service members were randomly selected to participate in an anonymous DoD-sponsored survey. These members were instructed to report to the appointed place and time on the military base where they were serving on active duty. The members listened to the purpose and overview of the survey from a civilian spokesperson. When asked if there were any questions, one member raised their hand and asked if the survey was mandatory and if they had to participate. This member was told that participation was not mandatory and they were free to leave if they chose not to participate. The military member glanced around the room and realized that they could indeed leave, but yet did not feel completely free to leave. Many of the participants sitting in the room were co-workers, colleagues, and even superiors. This member felt if they walked out, other people might follow and they might be judged negatively. Although anonymity when participating in the study was assured, a decision *not* to participate would *not* have been anonymous. In this

true account, the informed consent process was appropriately explained and the military member was not unduly coerced to participate. However, the structure for soliciting participation, the wearing of military uniforms with rank and nametags visible, created undue pressure on the military member. In the end, the military member participated in the study, knowing that they had a right and "permission" *not* to participate.

The military organization and ethical principles

The Belmont Report, issued in the United States in 1979, was the work of the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research and is considered a seminal document that has shaped ethical standards for human subject's research. This report advanced three principles for the conduct of research: beneficence, justice, and respect for persons (Singer, & Bossarte, 2006).

The tenets of the principle of beneficence guides the researcher in securing the overall well being of human subjects by reducing the risks involved in research studies. The application of justice in research dictates there must be an equal distribution of responsibility, between the researcher and the institutional review board, and that no single party should carry an unfair burden (Bankert & Amdur, 2006). The *respect for persons* principle has two parts. First, individuals should be treated as autonomous persons, and second, persons with diminished autonomy are entitled to protection. Military members may have diminished

autonomy because the very nature of *belonging* to the military organization requires the members to place the needs of the military, *before* their own (Widnall & Fogleman, 1995).

Most non-military workers (employees) do not pledge an oath before beginning their work with an organization. However, before beginning service to the military, military members raise their right hands and swear an oath of service. With this oath their work responsibilities change. Military members serve their country on the battlefield and embody the core value of integrity. But, should military service include completing surveys and partaking in research studies without the additional protection afforded other vulnerable populations? When does consent begin and when does it end for a military worker (employee)? One could argue that *informal* informed consent might actually be given the day a service member enters military service, signs their name and states out loud their intent to bear true faith and allegiance to their country. However, when military members consent to serve in the military, consent to participate in research studies is not automatic.

Protecting Vulnerable Populations

The military is a unique institution. It can be challenging to match traditional military themes of "service before self" with research guidelines of informed consent. The researcher must bear the responsibility for ensuring research conducted with vulnerable populations as well as with military service

members be explained fully and always be based on their complete and voluntary informed consent. Service members should be aware of their right to refuse to participate, with no concerns about hidden ramifications or punishment if they decline.

Human research subjects should expect a written explanation about confidentiality and how it will be maintained, and an explanation about potential future uses of study data, as well as publications and presentations of data. They should also be informed that they have the right to re-negotiate consent and be completely protected and fully informed (Corti, 2000). Researchers conducting research with vulnerable populations should ensure that their subjects' ethical rights are fully protected and any perceptions of coercion are openly and appropriately addressed.

Conclusions

It is often said that those who ignore history are condemned to repeat it. Therefore continuous dialogue about informed consent issues will continue to lay the groundwork for research protective guidelines. Study subjects are more aware of their rights than they were in years past. A network of institutional review boards has been established at government agencies and research universities throughout the country. Now, instead of being excluded, vulnerable populations actively pursue participation in research protocols. The Belmont Report is more relevant than ever and has fostered the current era of even greater protectionism in

research (Blustein, 2007). This discussion of the unique military population illustrated a potential vulnerable population of human research subjects. There is a connection between the treatment of military service members as protected human subjects and the country's national security and protection. After all, soldiers who fight to protect the human rights of others must also be protected and deserve nothing less.

References

Bankert, E. & Amdur, R. (2006). *Institutional Review Board.* Jones and Bartlett: Sudbury, MA.

The Belmont Report (1979). *Ethical principles and guidelines for the protection of human subjects of research.* The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research.

Blustein, J. (2007). The history and moral foundations of human-subject research. *American Journal of Physical Medicine and Rehabilitation, 86*, 82-85.

Burns, N. & Grove, S. (2005). *The practice of nursing research: Conduct, critique, and utilization (5th ed.).* St. Louis: Elsevier Saunders.

Corti, L., Day, A. & Backhouse, G. (2000). *Confidentiality and informed consent*.

Hicks, L. (n.d.). Research with Children. Retrieved on October 18, 2007 from https://www.citiprogram.org

Kiefer, S. (n.d.). Research with prisoners as subjects. Retrieved on October 28, 2007 from https://www.citiprogram.org

Lerner, B. (2007). Subjects or objects? Prisoners and human experimentation. *New England Journal of Medicine,* 18, 1806-1807.

Levine, R.J. (1986). *Ethics and regulation of clinical research* (2nd ed.). New Haven: Yale University Press.

McManus, J., Mehta, S., McClinton, A., DeLorenzo, R. & Baskin, T. (2005). Informed consent and ethical issues in military medical research. *Academy of Emergency Medicine*, 11, 1120-1126.

Parvizi, J. Tarity, T. Conner, K. & Smith, B. (2007). Institutional review board approval: Why it matters. *Journal of Bone and Joint Surgery, Inc.,* 89-A, 418-426.

Paul, D. (n.d.). Informed consent, an ongoing process. Retrieved on October 18, 2007 from https://www.citiprogram.org

Rose, S. & Pietri, C. (2002). Workers as research subjects: A vulnerable population. *Journal of Occupational and Environmental Medicine,* 44, 801-805.

Singer, E. & Bossarte, R. (2006). Incentives for survey participation: When are they "coercive?" *American Journal of Preventive Medicine,* 31, 411-418.

Widnall, S. & Fogleman, R. (1995). *Core values for the United States Air Force.*

Epidemiologic Factors Associated with Increased Body Mass Index in Active Duty Military Engaged in Vigorous Physical Activity

Julie M. Bosch, Major, USAF, NC

UNIFORM SERVICES UNIVERSITY OF THE HEALTH SCIENCES

Graduate School of Nursing

DOCTORAL NURSING DEGREE

Abstract

The focus of this descriptive-comparative study is to investigate the epidemiologic factors associated with increased body mass index in active duty military engaged in vigorous physical activity. These factors will be framed using the traditional Epidemiological Triad, composed of the host, the agent, and the environment. The associated variables are age, gender, branch of service, race and body mass index (the host), vigorous exercise, fast food intake, and fruits/vegetable intake (the agent), and mandatory fitness standards, deployment readiness, and access to care (the environment). Despite high rates of self-reported vigorous exercise, the military is far from meeting the *Healthy People 2010* Healthy Weight objective. The research questions will be answered through secondary analysis, using data obtained from the 2005 Survey of Health Related Behavior among Military Personnel and the 2005 Behavioral Risk Factor Surveillance System. The military sample will be compared to the non-military sample to assess for groupwise differences and relationships on the variables of interest. Descriptive statistics will be used to describe both samples and the study variables. Parametric and non-parametric statistical tests will be used to examine the relationships between the host variables and the agent variables, between the host variables and the environment variables, and between the agent variables and the environment variables for each data set (based on the Epidemiological Triad Model). Logistic regression will be used in an attempt to build a predictive model of high body mass index based on the study's variables. It is hoped that examination of this data will provide a better understanding of the environmental factors that impact the military populations body mass index as it relates to vigorous exercise. Understanding

this relationship will ensure the optimal health of the military service members and

enhance operational readiness of the US fighting forces.

SECTION A: SPECIFIC AIMS

The 2005 Department of Defense (DoD) Survey of Health Related Behaviors Among Military Personnel (SHRBAMP) results concluded that overweight or *pre-obesity* in military personnel is now *higher* than in the non-active duty population. Consistent with the nationwide trend, overweight based on body mass index (BMI), increased from **50.0% in 1995 to 60.5 % in 2005** for active duty members aged 20 or older. These results parallel a concurrent **increase** in strenuous exercise consistent with the military's emphasis on physical fitness (Bray, Olmsted, Sanchez, & Hartzell, 2006) and suggest that overweight originates from other factors, besides physical activity (Prentice & Jebb, 1995).

The former US Surgeon General of the United States Public Health Service, Dr. Richard H. Carmona, stated that the threat of obesity in America is as real as the threat of weapons of mass destruction (Basu, 2004). Active duty military personnel are at increased risk for disease co-morbidities related to being overweight and this trend can affect troop retention and threaten the military's operational readiness. **Our long term goal** is to understand the relationship between body mass index and vigorous physical activity in an active duty population living in a unique military environment that includes access to care, mandatory physical fitness standards, and readiness for deployment.

The **purpose** of this study is to describe epidemiological factors associated with increased BMI in active duty military personnel engaged in vigorous physical activity. The **overall objective** is to analyze existing data from the 2005 DoD SHRBAMP, and compare these data to existing data from a non-DoD national survey, the 2005 Behavioral Risk Factors Surveillance Survey (BRFSS). Despite emphasis on fitness and readiness, the US military has experienced substantial increases in overweight and obese personnel (Poston et al, 2005). The **central hypothesis** is that there will be no difference in BMI rates and vigorous exercise between active duty military personnel in a unique epidemiological environment and a non-active duty comparison group. If there is no difference, then current reliance on the unique environment of the military for control of BMI must be revaluated and other mechanisms identified to address high BMI rates and potential co-morbid conditions.

The variables will be framed by the Epidemiological Triad Model, which was originally used to address infectious disease epidemics, but noncommunicable diseases have also benefited from this approach (Mullis, et al, 2004). We propose using the model to frame this study, moving the research focus away from the traditional biomedical paradigm, and examining it in an epidemiologic framework with a much broader view (Egger, 2003). The model will be comprised of the host (age, gender, branch of service, race and BMI), the agent (vigorous exercise, fast food intake and fruit and vegetable intake) and the environment (access to care, mandatory fitness standards, and deployment readiness). This study proposes a unique and innovative view, not solely from an individual perspective, but from an epidemiological standpoint better suited to develop future intervention programs,

The **specific aims** of the study are:

1. To describe the relationship between epidemiologic factors and increased BMI in active duty military who report engaging in vigorous activity in the 2005 SHRBAMP and non-active duty who report engaging in vigorous activity in the national health survey.

2. To compare the relationship between epidemiologic factors and increased BMI in active duty military personnel and non-active duty who report engaging in vigorous activity in the national health survey.

3. To determine the appropriateness of the Epidemiological Triad model to frame the comparison of increased BMI in active duty military and non-active duty who report engaging in vigorous activity in the national health survey.

This study proposes a unique and different view from an epidemiological standpoint, not solely a behavioral one. An understanding of the epidemiological triad will assist the health care professionals in understanding the weight problems of the patient population. Armed with this fresh perspective, the researcher hopes to discover helpful insights in how to design future weight loss interventions that are effectively customized to the needs of the military and identify aspects of the military environment that impact BMI.

SECTION B: BACKGROUND AND SIGNIFICANCE

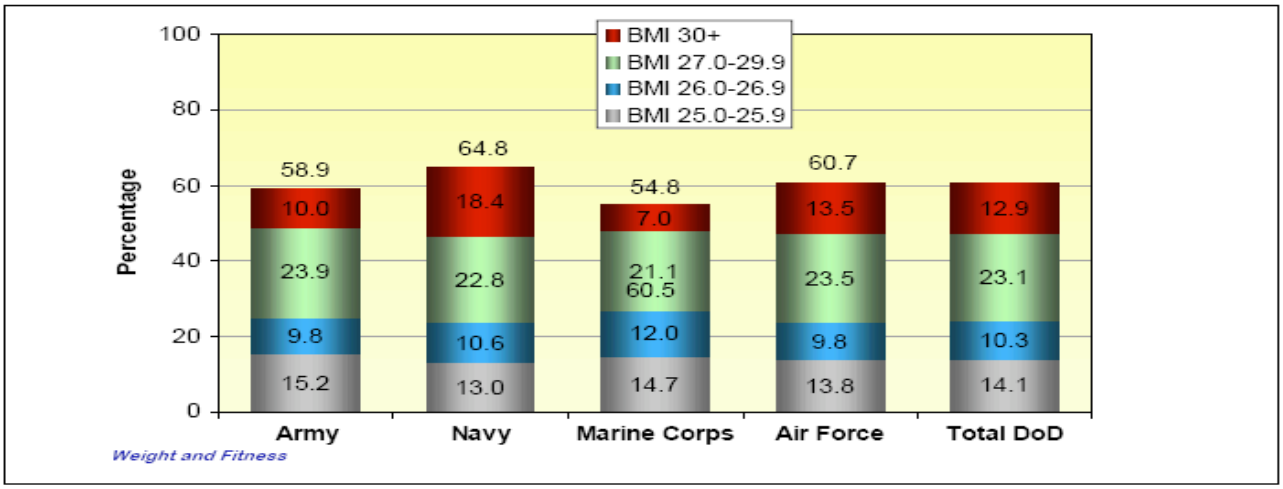
Military Relevance

The epidemic of overweight and obesity (as measured by BMI) affects the military services of the United States in numerous ways. It has a direct effect on retention of new recruits, in that, almost 80% of military recruits who exceed BMI standards at enlistment, leave the service before completing their first term (Institute of Medicine, 2003). These issues could threaten the welfare and operational readiness of the U.S. military.

The military is a unique culture with policies firmly in place regarding physical fitness requirements. In early 2004, the Air Force instituted a health based fitness assessment and screening test to determine if personnel were physically fit (US Medicine Information Central, 2003). Personnel were given duty time for exercise and activity levels increased. Subsequently, the Air Force no longer solely measures "fatness", (weighing its members, measuring BMI) but measures "fitness" (waist circumference, timed-run, and calisthenics,) Despite this new mandate, 77.1% males (35 years and older) in the Air Force are overweight and 21% are obese. New fitness programs, weight requirements, and annual evaluations may not be sufficient to ensure a fit and ready force.

Soldiers in the Army must maintain their physical fitness levels to complete their arduous mission of ground troop support. Their BMI statistics are virtually identical to the Air Force. The Navy's current rate of overweight males (based on BMI), ages 35 and older, is the highest at 80.1%, with 23.1% obese. These are all-time high figures for all the services, and the numbers are increasing every year.

Figure 7.2 Elevated BMI by Service, 2005[a] (based on 1998 NHLBI BMI Guidelines)



[a]Differences in total Body Mass Index (BMI) are significant at the .05 level for Army vs. Navy, Navy vs. Marines, Navy vs. Air Force, and Marines vs. Air Force. National Heart, Lung, and Blood Institute (NHLBI) defined BMI greater than 25 as a screener for overweight status. BMI is based on self-reports of height and weight and does not differentiate between muscle and fat. Numbers in bars may not sum to totals because of rounding.

Despite nation-wide interest in *Healthy People 2000* and *2010* objectives, few published studies have examined the objectives with regards to military personnel. However, one study reported progress toward the *Healthy Behavior 2010* 'physical exercise' objective across all active-duty services as measured by the 1995, 1998, and 2002 DoD SHRBMP (Bray, Olmsted, Williams, Sanchez, & Hartzell, 2006). Self-reported regular physical fitness and strenuous exercise increased in all the services, consistent with the military's emphasis on fitness.

However, another Healthy People 2010 objective is ≥ 30% of Americans will engage in vigorous physical activity at least three times a week. The 2002 DoD SHRBMP results showed that 70% of military personnel self-reported that they met this objective. In 2005, the definition of

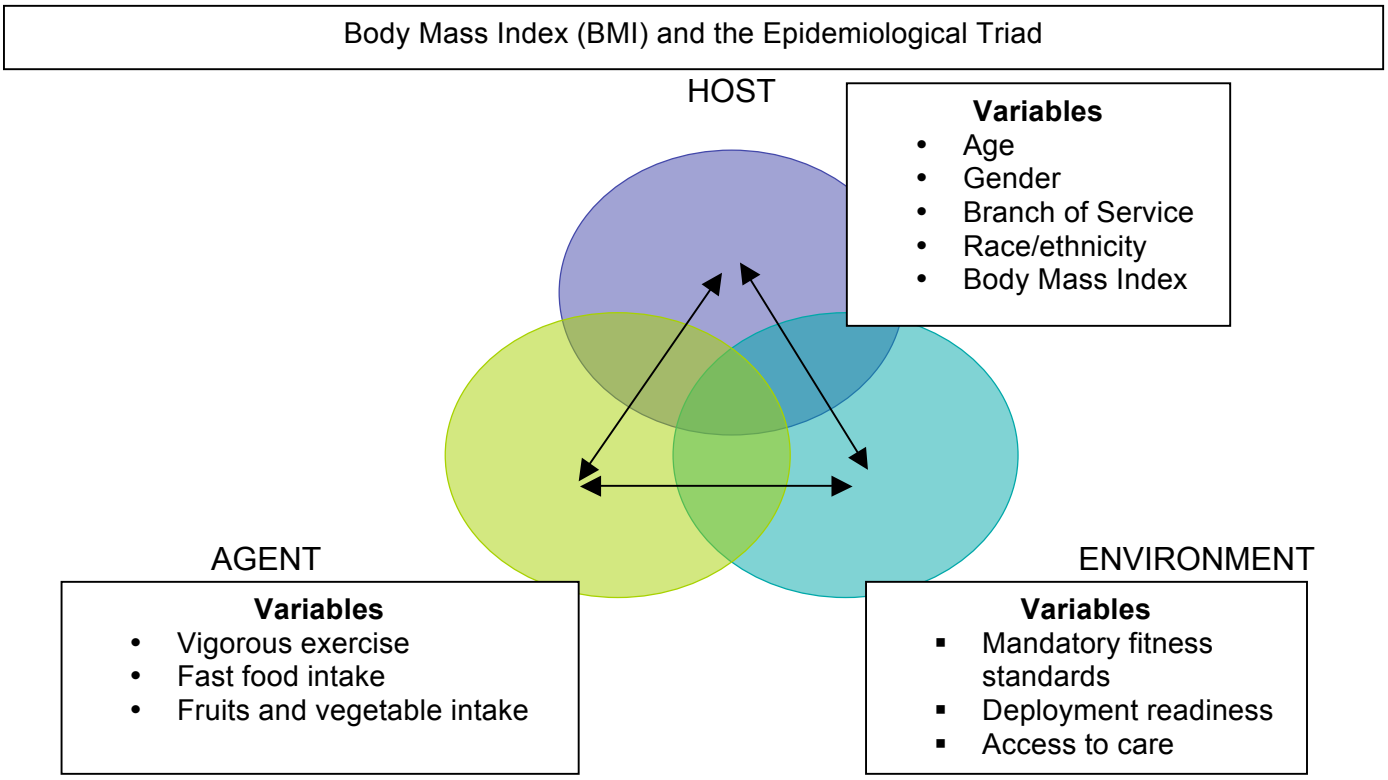
"vigorous exercise" was redefined; but the results were still high at 57.6%, far exceeding HP 2010 goals. Despite these high rates of self-reported vigorous exercise, the military is still far from meeting the HP 2010 Healthy Weight objective. This study will explore this unexpected and potentially dangerous disconnection between these two measured objectives.

Conceptual Framework

The traditional epidemiological triad model (host, agent, and environment) has historically been applied to infectious disease epidemics. In the traditional model, the host could refer to fleas or cattle that carry infection, the agent might refer to drinking water or mosquitoes that transmit the infection, and the environment might refer to a situation that contributes to transmission of infection such as crowded living conditions.

Epidemics have been best controlled when attention is paid to all three points of the triad. In 1980, William Haddon applied the triad approach to injury prevention and this led to large-scale reductions in motor vehicle injuries in the ensuring years (Egger, 2003). The researcher proposes that body mass index in the military could be tackled in a similar fashion with the same successful results. The variables associated with each triangle of the triad will be clarified, as well as their relationship to each other and potential interventional approaches can be identified..

The host corner of the triad has been traditionally the target for most weight control interventions and defined as biological factors and behavioral choices of the individual. The agent corner of the triad has been viewed as the active cause of the problem, which is energy input and energy expenditure of the individual (exercise and physical activity). The environment corner has been defined as the physical, economic, and sociocultural factors of the population. Modern environments have lead to changes in food production (increased fast food intake, for example) and energy-saving technologies (dependence on automobiles), which favor a positive energy balance and a predisposition for an obese population.



Review of the Literature

Healthy body weight is an extremely complex issue. Maintenance of fitness and appropriate BMI by military personnel is affected by each person's genetics, physiology, age, physical activity level, diet, environment, and social background. Some of these factors are biologically programmed; some can be manipulated by the individual, while other factors require environmental changes (Institution of Medicine, 2003).

Specific aim #1: To describe the relationship between epidemiologic factors (**host** = age, gender, branch of service, race and BMI, the **agent** = vigorous exercise, fast food intake and fruit and vegetable intake and the **environment** = access to care, mandatory fitness standards, and deployment readiness) and increased BMI in active duty military who report engaging in vigorous activity in the 2005 SHRBAMP.

Individual soldier combat readiness through enhanced physical fitness is a major emphasis in the United States military (Wynd & Ryan-Wenger, 1998). The physical fitness of military personnel is an important attribute that directly influences the effectiveness of the military organization and the outcomes of the mission. Each branch of the U.S. armed forces has unique standards for physical fitness and weight standards, as well as programs and policies in place, to ensure compliance with these standards (Robbins, Chao, Fonseca, Snedecor & Knapik, 2001).

There have been significant shifts in eating habits and exercise during the past 20 years and the military has not been immune to those shifts. Some of these changes are in food availability and composition (increased fast-food consumption), and technological changes that greatly decrease physical movement and activity (IOM, 2003). This reduction in physical activity is inherent to the new modern military, with more jobs reflecting a sedentary emphasis as opposed to years past.

In affluent societies, foods high in fat are abundant and physical activity has been drastically reduced. For the individual who is susceptible to obesity, this excess of food energy leads to an

accumulation of fat in cells, and eventually to obesity. Therefore, the activity levels required to meet the fitness standards in today's military may not be adequate to prevent an overweight epidemic in an obesogenic environment (Eggers, et al, 2003).

The effects of excess weight are far-reaching and can impact the performance of military members. Several studies have reported success rates for maintaining weight loss have been low, obesity experts to argue the single most effective approach is prevention (Robbins, Chao, Baumgartner, Runyan, Oordt, & Fonseca, 2006). Naghii (2006) stated preventing obesity or treating it in the initial stages was more effective than attempts to lose weight. Data suggest that higher levels of physical activity (PA) at baseline are associated with a reduction in the future risk of becoming overweight. This could have relevance in a military population, as the rates of overweight personnel are much higher over age 20, as compared to 20 and younger. In the 2006 nonrandomized controlled trial, Robbins et al., concluded intervention was effective at preventing weight gain in a large-scale population, as compared to the control groups. Targeting the younger military members and implementing prevention programs early in their careers, may be a worthwhile strategy to prevent future weight gain.

Physical activity represents an important component of the epidemiological triad, and represents the individual's energy expenditure. Reductions in physical activity due to modernized and industrialized societies, has likely contributed to positive energy balance and weight-gain. Among adults who have successfully maintained weight loss over time, a common factor is increased physical activity (Klem et al., 1997 (as cited in Institute of Medicine, 2003).

Sakuta & Suzuki (2006) conducted a cross-sectional analysis of the association between duration of physical activity and the presence of cardiovascular risk factors in middle-aged male personnel of the Self-Defense Forces during a routine retirement check-up. Using univariate regression analysis, duration of high intensity PA (not moderate or low intensity), inversely correlated with BMI, triglyceride and glucose levels, as well as blood pressure. Numerous studies have reported similar findings, that physical activity may reduce the incidence of chronic diseases by favorably altering blood lipid profiles, reducing body fat, and improving lean body mass (Eliakim et al, 1997, as cited in Institute of Medicine, 2003).

Another important dietary factor is the increased consumption of fast food. Its origins date back to the 1950s and it has evolved into a dominant eating pattern in the U.S. There are several studies that address fast food as it relates to the obesity epidemic or the increased BMI in service members. In a 2005 study (Pereira, Kartashov, Ebbeling, Van Horn, Slattery, Jacobs, & Ludwig), over 3000 participants in the CARDIA study were followed up with repeated dietary assessments over a 15-year study. The results showed a strong positive association between increased fast-food consumption, weight gain and insulin resistance.

Specific Aim #2*:* To describe and compare the relationship between epidemiologic factors (**host** = age, gender, branch of service, race and BMI, the **agent** = vigorous exercise, fast food intake and fruit and vegetable intake and the **environment** = access to care, mandatory fitness standards, and deployment readiness) and increased BMI in active duty military personnel and non-active duty who report engaging in vigorous activity in a national health survey.

In a study by Adams & Schatzkin (2006) published in the *New England Journal of Medicine,* the authors reiterated that obesity (BMI ≥ 30.0) is associated with an increased risk of death. However, the relationship between being overweight (BMI of 25.0–29.9) and an increased risk of death had not been as extensively studied. This study prospectively examined BMI in relation to the

risk of death from any cause, in approximately 525,000 U.S. males and females from the National Institute of Health (NIH)-AARP cohort, between the ages of 50-71. (Although, the average of the military member is much younger, it can be argued that the younger end of this cohort could be active-duty, while others in the upper-age spectrum could represent military veterans). During the follow-up period of ten years, analyses showed an increased risk of death in *both* overweight and obese subjects. In analyses of BMI during midlife (age 50), among those who had never smoked, the associations with the risk of death increased by 20-40% among overweight persons, and by two to three times among obese persons. As increased BMI (overweight) in military members is now equal or higher than the civilian community, this suggests long-term effects on morbidity and mortality risk, as well as soaring health care costs in the DoD.

Riley, et al (2005) conducted a prospective study to examine the effectiveness of self-assessed fitness and exercise in predicting objectively measured physical fitness. The 1,583 male subjects (entering the Marine Corp) completed a questionnaire and an objective fitness test. Multivariate modeling found numerous measures of self-assessed fitness were all associated with the objective fitness score. If the subjects self-assessed a high level of fitness, this correlated with a high score on a fitness test. This study has important ramifications with the results of the 2005 SHRBAMP, where the majority of military members self-reported high rates of regular and vigorous physical exercise (56%-73%), yet the calculated variable of their BMI was at an all-time high, 61%. It is possible military members inflate their self-reported physical activity frequency, as well as PA intensity.

The effects of physical activity on weight and health may be influenced by age. In a 2004 study by Hawkins & Cockburn et al, the purpose was to describe the prevalence of moderate and vigorous physical activity among 40,000 native Californians in relation to age, gender, education, and self-reported disease risk factors. The relationship between demographic variables, chronic disease risk factors, and meeting physical activity (PA) guidelines was analyzed. Significant age and education gradients existed for both moderate and vigorous PA. An inverse association was noted between PA guidelines and prevalence of chronic disease risk factors. This study could have implications for more effective targeting of PA guidelines of U.S. adults, including those serving in the military. In contrast to the 2005 SHRBAMP self-reported results, only 22.3% of the total group reported moderate amounts of PA (according to CDC and ACSM guidelines) and 37.4% reported vigorous amounts of PA. In addition, an inverse association was noted between both types of PA and prevalence of chronic disease risk factors.

However, the effects of health education have initiated a shift from personal to environmental factors of eating and physical activity. In a (2006) study, Brug, Lenthe, & Kremers, six systematic reviews were conducted of environmental correlates and interventions for weight-related eating behaviors and physical activity for both children and adults. The review of 297 observational studies illustrated few studies of environmental associations have been replicated. The researchers argued that better-designed and vigorous research on the true importance of environmental factors for obesogenic behavioral change is needed.

Specific Aim #3*:* <u>To determine the appropriateness of the Epidemiological Triad model to frame the comparison of increased BMI in active duty military and non-active duty who report engaging in vigorous activity in the national health survey.</u>

The overweight military population has been traditionally targeted via behavioral weight loss programs (both individual and group). The epidemiological model will facilitate interventions to operationalize variables in a new and innovative way, using all three corners of the triad, the host, the

agent, and the environment. Endocrine scientists assert an epidemiological model may be a more comprehensive way to look at increased BMI than the traditional energy balance model (The Endocrine Society, 2007).

If increased BMI is associated with military environmental factors, current and future research should focus on environmental changes, as well as the individual's willpower and health behavior choices (Cornell University, 2007). The military fitness standards may have to be re-evaluated or the physical activity levels of military personnel increased.

Documenting the environmental influences on a population's physical activity and eating behaviors poses a considerable challenge, as these influences are difficult to define and measure. A new era of research about methods that measure exercise and eating behavior associated with environmental factors is clearly needed (French, Story, & Jeffery, 2001). A population's ability and opportunity to make healthful behavior changes may depend on the environment. Egger and Swinburn (1997) suggested many years ago that obesity should be regarded as a normal response to an abnormal environment.

SECTION C: PRELIMINARY STUDIES

In the proposed study, data from the 2005 DoD Survey will be matched and compared to data from a non-DoD national survey data sets, the 2005 Behavioral Risk Factor Surveillance Survey (BRFSS). The purpose of this comparison will be to identify and describe epidemiologic factors associated with increased BMI. Data will be analyzed to assess comparability of military personnel characteristics to non-military personnel while controlling for epidemiologic factors unique to the military.

2005 Survey of Health Related Behaviors Among Military Personnel (SHRBAMP)

DoD Surveys of Health Related Behaviors Among Military Personnel (SHRBAMP) are cross-sectional and designed to represent active-duty service members from all branches of the military stationed worldwide. The survey is conducted every 3 years and has been used by the DoD to track changes in health behaviors. The SHRBAMP was initiated in 1980 and the 2005 survey is the 9th in the series. In 2005, DoD expanded the scope of the survey to include National Guard and Reserve members. This expansion will allow the researcher to gain vital health information about the Reserve component and make comparisons to military reservist's health behaviors from the national survey data sets.

The SHRBAMP is sponsored by the Office of the Assistant Secretary of Defense and the 2005 sample size was 16,000 military service members. Data primarily was collected from participants in group sessions on military installations. The survey was a self-administered paper-and-pencil questionnaire designed for optical-mark reader scanning and contained measures regarding self-reported specific health risk behaviors. This researcher conducted an evaluation of this data set and applied specific criteria to ensure its validity and reliability.

Accessing data set and accompanying documentation: The 2005 DoD SHRBAMP is easily located on the web and includes a highlight report, a final report and public use file code book. The analytical data is available from DoD if one is directly involved in DoD health promotion or research, and upon completion of a non-sensitive data use agreement. This agreement requires the researcher to give information about research intent, school program, and specific plans for the data analysis. The codebook contains information about the variables, recoding information, coding schemes and summary statistics. Since the original survey was completed in 1985, there is helpful information about how the survey has evolved, based on the changing health risk behaviors of the military force. The research teams' names are listed with a specific point of contact.

Data quality assessment: This survey is the 9th in a series and well-received in the scientific community. The DoD survey was collected and analyzed by a civilian contract company, RTI International. The procedures and data processing are clearly described in both the highlights and final report. Both reports are well organized and contain a well written methodology section, including sampling design.

During the Fall of 2005, a pilot study was conducted at one installation per service to test the adequacy of item wording, formatting and response choices. Based on feedback from debriefings of participants, some item formatting was modified to improve clarity. In total, 48 new questions were added to the 2005 survey to reflect changing health behavior trends.

The survey report states that during the Phase I group sessions, participants were assured of anonymity, informed of the voluntary nature of the survey, and an ombudsperson was placed at every sample site during data collection. However, if an eligible member failed to attend their scheduled survey session, they were contacted and asked to attend a subsequent one.

Sampling technique: The target population included all military personnel who were on active duty during the time of data collection (April through August 2005). A primary objective of the sampling design was to facilitate the group administration of the survey on-site. Due to the worldwide distribution of military personnel, a dual-mode sampling design was developed and included group-administration at large installations including ships, and surveys mailed to persons in smaller locations where an on-site group session was not practical. This survey is a multistage cluster sample with duty stations and ships representing the geographic or primary sampling units. The group-administered portion of the study was referred to as Phase I and the mail portion was Phase 2 of the data collection effort (2005 DoD SHRBAMP Executive Summary).

The final sampling frame consisted of 395 military installations, which could accommodate the on-site administration of the survey to at least 500 persons. Approximately 90% of all active duty service members sampled were stationed at these installations. After sample selection, a sampling weight was calculated for each sample member. The sum of the sampling weight was approximately 1.2 million, based on all active-duty sample members. This sum estimates the approximate number of persons with a positive probability of being selected.

Measurement strategies: The information available is the data structure (relationship between records and fields), the variables of interest, identifying supplemental variables, and labels to identify the variables and values for output (Haley, 2006). The codebook contained clear variable information, recoding information and summary statistics. It is common to use either SPSS or SAS for extracting data, as they both have robust data manipulation capabilities (Haley, 2006). For this proposed study, SPSS will be used for data analysis.

The data set uses core questions in a self-administered questionnaire to obtain personal level information about health behaviors. The wording of items in the survey was adequate, with exceptional organization of the topic areas to enhance user-friendly readability. There were numerous questions that were lengthy and could be misinterpreted by the respondent. The survey measured over 21 broad areas of health behaviors, for example, socioeconomic status (SES), military experience, weight/height, mental health, stress, and exercise.

Validity: External validity has the potential to be the strongest threat in SDA. Since many large data sets use complex sampling designs, the results obtained during analysis may be more generalizable than in smaller studies. Large sample sizes can also artificially inflate the significance of results (Magee, 2006). History is also a potential threat to internal validity, when data sets used are a combination of successive years of data.

The 2005 DoD survey final report stated the validity of self-report data among respondents from U.S. civilian general population had been tested in relation to alcohol and drug use. Overall, the

various reviews in the literature suggest that self-reports can be reliable and valid. A general conclusion is that most people appear to be truthful under the proper conditions.

There was a 51% completion rate for Phase 1 data collection. This rate affected data-processing costs and the missing data contributed to the potential for biases. This response rate has remained constant since the initiation of this survey in 1998. Missing data is an issue in all research and must be adequately addressed in SDA. Large data sets often contain missing data, particularly when respondents choose "don't know" or "not sure" when answering survey questions.

Support for the validity of 2005 data derives from the methodological rigor employed by a neutral team of researchers that encouraged honest reporting. The study highlights that questionnaires were answered privately, participants have remained anonymous, and research teams assured participants of data confidentiality.

Level of data and analytical capabilities: Levels of measurement included nominal, ordinal and interval. For continuous variables, the range of responses was provided with interpretation of the meaning of any value falling within that range. For discrete variables, all possible response categories were provided under each variable description and frequency of responses.

Potential interpretative issues: As with all surveys, systematic non-response can increase bias into survey estimates (2005 DoD final report). To mitigate this risk, the sample member who could not attend the group administration (due to remote location) was mailed a questionnaire.

The national standards for BMI have changed over time. In the Summer of 1998, the National Heart, Lung, and Blood Institute (NHLBI) developed new BMI guidelines for weight. For example, overweight was defined as a BMI of 25.0 to 29.9 (NHLBI, 1998). *HP 2010* set goals to encourage adults over age 20, to maintain a *healthy weight,* defined as a BMI greater than 18.5 and less than 25.0. In 2005, the Departments of Health and Human Services and Agriculture released new *Dietary Guidelines for Americans that* were the same as the NHLBI guidelines for persons over age 20. The changes in national acceptable standards impact the difference in which overweight is calculated for individuals less than 20 years. The final report provides a comparison table of both BMI standards.

Due to the high turnover among military personnel, data from the DoD surveys over years, are from different populations. Some individuals serving in the military in the early 1980s were no longer serving in 2005. As with most cross-sectional serial surveys, researchers and analysts must use caution in drawing conclusions about observed changes in rates of health behavior through the years.

Military populations have special needs and exist inside a different culture but are seldom included in any of the national surveys that examine health objective achievement in the U.S. In this study, data collected in national data sets will be used as proxy data to gain valuable information about the DoD population. This new knowledge can be used to create programs to combat pre-obesity and prevent obesity in the military population, identify chronic diseases related to increased BMI, and lay the groundwork for future DoD research. Partly due to the results of the 2005 SHRBAMP and its' highlight on increased BMI, the DoD and TRICARE launched the Healthy Choices for Life initiative, focusing on weight management.

2005 Behavioral Risk Factor Surveillance Survey (BRFSS)

.

The national survey in this research study is the 2005 Behavioral Risk Factor Surveillance System Survey (BRFSS). This is the largest continuously conducted telephone health survey in the world. It enables the Center for Disease Control and Prevention (CDC), state health departments and other health agencies to monitor risk behaviors related to chronic diseases, injuries and death. The BRFSS is an effective tool in preventing disease and promoting health.

The BRFSS was established in 1984 by the Centers for Disease Control (CDC) and for many states, it is the only source of accurate data regarding certain health-related behaviors. More than

350,000 adults are interviewed annually, and the results have lead to new public health policies and programs, as well as to identify emerging health problems.

The BRFSS is unique in several ways. State participation is critical to ensure achievement of national health goals, however, national data is not always appropriate for any given state. In addition, the BRFSS is an established and well-regarded telephone survey, as sampling for household interviews is not always cost-effective and in certain states, not available. The CDC developed standard questionnaires for states to use, and although each state's survey may be slightly different, the data can be compared across states.

The BRFSS questionnaire is developed jointly by CDC and health state departments. The questionnaire has five sections: 1.) Fixed core, 2.) Two rotating cores, 3.) Optional modules, 4.) Emerging core, and 5.) State-added questions.

The core questionnaire is a standard set of questions asked by all states. It includes questions about current health-related issues, as well as demographic questions. Future core questions typically focus on late-breaking health issues and are evaluated each year to determine their potential value in future surveys. Factors assessed by the core-BRFSS include health care coverage, physical activity, tobacco use, and fruit and vegetable consumption. There are also 'Rotating Core Questions' that are asked every other year, and cover topics such as (even-numbered years) physical activities and weight control.

There are optional CDC modules about specific topics that states can choose to use with the core survey. In addition, states can develop their own state-added questions, based on their needs, but these are not edited by the CDC. Past topics have included: fruit and vegetable consumption, exercise, weight control, hypertension awareness and health care coverage.

Accessing data set and accompanying documentation: The BRFSS is easily located on the internet, the web site is organized and the purpose of the data collection is outlined. Documentation to include the code book, survey overview, variable layout, and summary data quality report is accessible to the researcher. The Code Book clearly outlines a coding scheme and contains summary statistics. The researcher can download the Code Book without difficulty and review all 393 variables for consideration into this study. There is no data use agreement necessary to obtain the data, as the data set is for public record.

Data quality assessment: BRFSS data is collected and transmitted to the CDC's National Center for Chronic Disease Prevention and Health Promotion for editing, weighting, processing, and analysis. Data collectors and their standardized training are clearly described on the main web site. Interviewers are specially trained to ask questions exactly the same way with every phone call made. Most interviewers use Computer Assisted Telephone Interview (CATI) software to manage dialing and data collection. The standardized interview takes 10 to 20 minutes and responses are entered directly into the computer by interviewers.

Procedures for data collection are identifiable, scientific and updated annually. Interviewing procedures, training of the interviewers, and data processing are time-tested and well-regarded. Accessible on the BRFSS web site is a Summary Data Quality Report for each year, that provides selected statistical indicators of data quality in the BRFSS. The reports present data such as outcome measures, selection biases, and missing values based on income.

Sampling technique: It is impossible to phone every household in each state every year, therefore the BRFSS relies on a sample of the population. This method assures comparability of data across states and over time. Most states use the Disproportionate Stratified Sample (DSS) Method. With this method, phone numbers are randomly selected in each state, and individuals age 18 years and older are randomly selected from each household called. States make calls 7 days per week and each state completes between 125-625 interviews per month.

Measurement strategies: The codebook documentation will be reviewed with accompanying value labels, and descriptive inferential statistics will be determined.

Level of data and analytic capabilities: The data set contains 294 variables, 7 identified as nominal level of measure, the others are scale measure. After BRFSS survey data results are analyzed, the results are used to published scientific articles in professional journals, educate the public and to benefit health research (BRFSS Overview).

Potential interpretative issues: It is important to understand that any survey will have variation across sample sites between states, therefore variation between states is to be expected. The complex sample design and the many reporting areas complicate the analysis of the BRFSS.

Table 1: Major Variables, Definitions, and Measures

Variable Name	Conceptual Definition	Operational Definition	2005 SHRBAMP Measure	2005 BRFSS Measure
Age	Component of the HOST in the Epidemiological Triad	Demographic information	Age at last birthday.	What is your age?
Gender	Component of the HOST in the Epidemiological Triad	Demographic information	Are you male or female?	Indicate sex of respondent.
Race/ethnicity	Component of the HOST in the Epidemiological Triad	Demographic information	What is your race?	Which one of these groups would you say best represents your race?
Branch of Service	Component of the HOST in the Epidemiological Triad	Demographic information	What service are you in?	Have you ever served on active duty in the US Armed Forces, either in the regular military or in a National Guard or military reserve unit? Which of the following best describes your service in the United States military? (can self-identify if they are on active duty status)
Body Mass Index	Component of the HOST in the Epidemiological Triad	Standardized measure calculated from an individual's weight in kilograms divided by the square of their height in meters (kg/m2).	** Calculated variable ** About how tall are you without shoes on? (height) About how much do you weigh without shoes on? (weight)	** Calculated variable** About how tall are you without shoes? (height) About how much do you weigh without shoes? (weight)

Table 1: Major Variables, Definitions, and Measures

Variable Name	Conceptual Definition	Operational Definition	2005 SHRBAMP Measure	2005 BRFSS Measure
Vigorous Exercise	Component of the AGENT in the Epidemiological Triad	The activity of exerting muscles in various ways to keep fit.	During the past 30 days, for leisure-time physical activity, how often (and for how long?) did you usually do each of the following? (vigorous activity described)	During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise? Thinking about the vigorous activities you do in a usual week, do do vigorous activities for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate? How many days per week do you do these vigorous activities for at least 10 minutes at a time? On days when you do vigorous activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?
Fast-food intake	Component of the AGENT in the Epidemiological Triad	Inexpensive food such as hamburgers & fried chicken, prepared & served quickly.	In average week, how often do you eat fast food?	No question about fast-food intake.
Fruits & Vegetables intake	Component of the AGENT in the Epidemiological Triad	Related to how often fruits & vegetables are eaten	In an average week, how often do you eat fruit? In an average week, how often do you eat vegetables?	Not counting juice, how often do you eat fruit? How often do you eat carrots? How often do you eat green salad? Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat?

Table 1: Major Variables, Definitions, and Measures

Variable Name	Conceptual Definition	Operational Definition	2005 SHRBAMP Measure	2005 BRFSS Measure
Mandatory fitness standards	Component of the ENVIRONMENT in the Epidemiological Triad	Standards for physical fitness levels, regularly tested in each Armed Forces branch	Do you have difficulty meeting your service weight and/or body fat standard? Did you pass your most recent physical fitness test? Are you currently enrolled in a mandatory weight control/management program?	No question pertaining to mandatory fitness standards. (Default to answer "no" for comparison to SHRBAMP data which is yes/no response.)
Deployment readiness	Component of the ENVIRONMENT in the Epidemiological Triad	Temporary military assignment which requires service member to leave their home and/or family.	How many times have you been deployed in the past three years? How many days during the past 12 months have you been away from your permanent duty station? When were you last deployed? Did you serve with the military in any of the following areas?	No question pertaining to mandatory fitness standards. (Default to answer "no" for comparison to SHRBAMP data which is yes/no response.)
Access to care	Component of the ENVIRONMENT in the Epidemiological Triad	Availability of health services	Default to answer, yes.	Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare? Do you have one person you think of as your personal doctor or health care provider? Primary source of care? Availability of primary services? Availability of preventive services? Availability of Veterans health care?

SECTION D: EXPERIMENTAL DESIGN AND DATA ANALYSIS

Design

The purpose of this study is to describe epidemiologic factors associated with increased BMI in active duty military personnel engaged in vigorous physical activity. This proposed research study will use secondary data and a comparative descriptive design using multiple variables. There will be no experimental manipulation of variables or random assignment of subjects. This approach allows the researcher to examine questions related to the data set that were not originally asked during the primary research (Burns & Grove, 2005). Secondary Data Analysis (SDA) is a research process that uses existing data to answer research questions. When used to analyze population health data, secondary analysis is a way to generate knowledge to improve population health and meet current health care demands (Bibb, 2007).

When using SDA, the first step is to minimize error and increase validity by insuring a conceptual match between the primary data collection and the current existing data in the database (Magee, 2006). In this proposed study, the researcher will be studying the epidemiological factors of active-duty personnel who have increased BMI compared to a non-military population who have increased BMI. The researcher will be using the 2005 DoD SHRBMP and the BRFSS for comparisons of variables. See Table 1. The research analysis will be performed at the Uniformed Services University of the Health Sciences (USUHS) located in Bethesda, MD.

The data used for this study will be identified and will not include coded identifiers. The researcher will not have access to any information (codes or keys) required to "identify" survey participants. Individual cases within the datasets will be tracked by an arbitrary cases number assigned only for the purposes of data analyses.

The inclusion and exclusion criteria for this study are as follows:

Inclusion Criteria

1. Age $\geq$ 20 years and $\leq$ 45

Exclusion Criteria

1. Age < 20

Confidentiality of Data

The researcher will use the data from the 2005 Survey of Health Related Behaviors among Military Personnel and the 2005 Behavioral Risk Factor Surveillance System only for purposes outlined in this protocol. Information from both data sets will be accessible only to those persons directly involved in conducting this study and members of the Uniformed Services University of the Health Sciences Institutional Review Board (IRB).

The BRFSS is a data set accessible to the public and does not require a Data Use Agreement. However, the SHRBAMP requires a Data Use Agreement and the researcher will implement appropriate procedural, administrative, and physical safeguards to prevent unauthorized use, disclosure, theft, or compromise of the DoD data. Unless renewed, the information related to the DUA will be retained until 24 October 2008.

Data from the 2005 SHRBAMP will be used only for the purpose (s) cited in the DUA and will not be released to any other organization without prior DoD approval. De-identified data is not subject to the requirements of the Health Insurance Portability and Accountability Act (HIPAA), however the researcher will ensure the data is protected from release to individuals other than those authorized to access the data. The researcher will not attempt to re-identify any part of the data and will destroy the data by the specified time outlined in the DUA.

For further requirements that apply directly to the use of the de-identifiable files, see the signed Data Use Agreement (#07-438) dated October 18, 2007 and the official approval letter from the TRICARE Management Activity Office dated November 14, 2007.

Specific Aim #1: To describe the relationship between epidemiologic factors and increased BMI in active duty military and non-active duty population who report engaging in vigorous activity in the 2005 SHRBAMP and 2005 BRFSS.

Rationale: The active-duty population is affected by the national obesity trend despite the emphasis on fitness and exercise. The military environment is unique in that it mandates fitness standards, its members have access to care, and members must be ready to deploy. Using the epidemiological model to frame the research question, allows the researcher to explore individual's health behaviors and as well as their environment.

Design: After obtaining Internal Review Board (IRB) approval from the Uniformed Services University of Health Sciences (USUHS), data will be requested from the 2005 SHRBAMP survey and the 2005 BRFSS for those participants meeting the inclusion and exclusion criteria. The researcher will complete an application for a DoD Data Use Agreement (DUA) for individual de-identified survey data. De-identified data consisting of the variables listed in Table 1 will be obtained in an electronic format under a data sharing agreement. The data files requested will be provided in independent and de-identified form only (DIF Data Use Agreement). There is no requirement for a DUA for the 2005 BRFSS national data survey results.

Data Analysis: Preliminary analysis of the data will evaluate descriptive information for each of the ten variables, to include (1) prevalence examination of key variables (2) identification of data outliers (3) associations among the variables (4) assessment of missing data. Basic analyses using simple measures of central tendency (means, medians, and mode), frequency distributions, variability (standard deviation) and associations (correlations) between variables will be performed, including zero-order and higher order correlations. Parametric and non-parametric statistical tests will be used to examine the relationships between the host variables and the agent variables, between the host variables and the environment variables, and between the agent variables and the environment variables for each data set (based on the Epidemiological Triad Model). See Tables 2 and 3.

Statistical Package for the Social Sciences (SPSS) for Windows 14.0 statistical software will be used to perform all the analyses. A .05 level of probability will be considered to indicate statistical significance for inferential statistical procedures.

Problems and Solutions: Missing data is likely to be a concern when analyzing the data from this data set. The researcher will identify the pattern and the amount of missing data, assess why it is missing and then determine what action to take. If only a few values are absent in a random pattern, almost any procedure for handling missing values can be used (Tabachnick, & Fidell, 2001). SPSS has a "System Missing" category that appears on the data spreadsheet and computer printout (Munro, 2005). List wise deletion is the default procedure in SPSS. This procedure will be used if the amount of missing data is considered small. The DoD data set is large enough to permit deletion of

cases with missing data. In either data set, there is a high likelihood of finding statistically significant differences between variables when there is not, due to the size of the samples.

Specific Aim #2: To compare the relationship between epidemiologic factors and increased BMI in active duty military personnel to non-active duty who report engaging in vigorous activity in the national health survey.

Rationale: The primary purpose of fitness and body composition standards in the military has historically been to choose individuals who can withstand the physical demands of military service. This assumption is proper body weight supports physical readiness and military appearance (Naghii, 2005). Increases in food consumption and modern technology have resulted in increased mean weight of soldiers and the population as a whole. By comparing a DoD data set to a non-military data set, the researcher hopes to explore the similarities and differences between the two groups with regards to increased BMI and physical activity.

Design: After obtaining Institutional Review Board (IRB) approval from the Uniformed Services University of Health Sciences (USUHS), the 2005 SHRBAMP data and the 2006 BRFSS data will be obtained. The researcher will complete an application for a DoD Data Use Agreement (DUA) for individual/aggregate survey data and obtain the BRFSS data (no DUA required). De-identifiable riles are provided in aggregate or summary form only (DIF Data Use Agreement).

Data Analysis: Preliminary analysis of the data will evaluate comparative information for each of the ten variables in one data set compared to the eleven variables in the national data set. The descriptive statistics will be the same as above in specific aim #1. Statistical Package for the Social Sciences (SPSS) for Windows 14.0 statistical software will be used to perform the analyses. A .05 level of probability will be considered to indicate statistical significance.

Problems/Solutions: The DoD and the CDC survey were collected for different purposes and from two different populations. The civilian population is more heterogeneous than the military population, therefore comparisons between the two groups will have to be carefully made and analyzed. The variables may not be exactly matched, for example, there is no question in the CDC data survey regarding deployment or mandatory fitness standards, the researcher anticipates this as a concern. In this case, these variables will be categorized as a yes/no for the military data set and a "no" for the civilian data set. There will be assumptions made regarding the unique environment of the military.

See Table 4. Assumptions will be made that the military participants' had access to care, have mandatory fitness standards and deployment readiness risk. Therefore, when comparing the military data set to the non-military data set with regards to these variables, it will be assumed the military have these unique features and the non-military participants do not. The researcher may compare BMI between both groups with regards to their vigorous exercise or the lack of mandatory fitness standards. It will be challenging to draw conclusions or make statements about significant statistical differences, but the researcher should be able to discern patterns from the data and begin discussions about the military's unique environment.

Data was self-reported so bias is a potential risk. This is inherent to self-report measurement approaches including the existing data studied (Burns & Grove, 2005). The most common in this study might be the underreporting of weight. However, studies of adults have demonstrated a high correlation between self-reported and measured height and weight (Nieto-Garcia, Bush, & Keyl, 1990). These data bases will be adequate for the exploration of this particular limitation and taken into account when analyzing the results.

Missing data will be handled in a similar manner as outlined in the above specific aim #1 problem/solution section.

Specific Aim #3*:* To determine the effectiveness of the Epidemiological Triad model to frame the comparison of increased BMI in active duty military and non-active duty who report engaging in vigorous activity in the national health survey.

Rationale: The epidemiological model has also been useful in combating epidemics related to morbidity and mortality in humans. The decline of health problems such as smoking, cervical cancer, and coronary heart disease have been attributed to the integrated approach of this model. The lessons learned from these successful programs can be applied to the prevention and treatment of obesity (Mullis et al, 2004).

Design: The Epidemiological Triad in the traditional use has reciprocal relationships assumed between the three components, the host, the agent and the environment. It is for this reason that the researcher will explore the relationships between the variables in this study, using these associations.

Data Analysis: Data will be collected as described above. Results from the analysis will be used to determine the usefulness of the Epidemiological Triad Model in examining relationships between host, agent, and environment variables. The researcher will use the theorized relationships based on the review of the literature to evaluate whether the use of the model was appropriate for this study.

HUMAN SUBJECTS PROTECTION

A. Nature and Location of Data Bases: A data use agreement (DUA) will be completed by the researcher and submitted to the SHRBAMP before obtaining the data. There is no DUA needed for the BRFSS. The 2005 DoD SHRBAMP and the 2005 BRFSS data will be located at the USUHS on a secure server accessible only to authorized personnel.

B. Recording of Extracted Data with Identifiers: The 2005 DoD SHRBAMP and the 2005 BRFSS data do not contain names, addressed, phone numbers, or social security numbers.

C. Location of Extracted And Recorded Data: The data sent to the PI will be stored on a DoD approved, secure, password protected computer.

D. Transmission of Extracted Data For Collaborative Research: The de-identified data will not be transmitted outside the USUHS.

E. Linkage of Extracted Data To Other Databases: None

F. Status of the Extracted Data After Completion of the Research Study: Once all data analyses are completed and papers published, the data will be held by the PI for three years for publication verification or audit purposes. It will then be destroyed.

G. Benefits: The potential findings will be solely used to enhance current understanding of the relationship between epidemiological factors and military members' body mass index.

H. Risks: The research involves no more than minimal risk to the subjects. There is minimal risk associated with this database analysis. There are no perceived physical or psychological risks to the subjects

GENDER AND MINORITY INCLUSION:

In the study proposed, there will be no exclusion based on race, ethnicity, or gender.

INCLUSION OF CHILDREN

Since this study focuses on the members of the armed services and compares them to a population in the non-military community and the population of the armed services includes persons over 17 years of age, there will be no data analyzed from children in this study.

IRB APPROVAL

IRB approvals from the Uniformed Services University will be obtained for the protocol before data analysis will begin. However, since these two data sets do not contain individually, identifiable private information, IRB approval is most likely not required.

.

	Oct 07	Nov 07	Dec 07	Jan 08	Feb 08	Mar 08	Apr 08	May 08	Jun 08	Jul 08	Aug 08
Receive notification of IRB Approval/Funding											
Obtain data from data sets/load into SPSS											
Clean/organize data											
Extract variables											
Code data/develop codebook											
Preliminary analysis											
Analyze data											
Data Interpretation											
IRB Final Report											
Manuscripts & Poster Preparation											

Table 2: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 SHRBAMP

Major Variable	Selected 2005 SHRBAMP Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
Age	Age at last birthday.	-What is the mean age of the respondents? - What is the relationship between age and BMI? - What is the relationship between age and vigorous exercise? - What is the relationship between age and fast food intake? - What is the relationship between age and fruits and vegetable intake? - What is the relationship between age and mandatory fitness standards? - What is the relationship between age and deployment readiness? - What is the relationship between age and access to care?	- Scale - Scale/scale - Scale/ordinal - Scale/ordinal - Scale/ordinal - Scale/ordinal - Scale/ordinal - Scale/ordinal	Descriptive statistics: frequency distributions and measures of central tendency. Pearson product moment correlation (r) (scale/scale) Analysis of variance/ANOVA (scale/nominal) Spearman rank correlation (ordinal/nominal) ** will need to change the scale to ordinal and test correlation with nominal variable ** for ex: make the age ordinal instead of scale

Table 2: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 SHRBAMP

Major Variable	Selected 2005 SHRBAMP Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
Gender	Are you male or female?	- What is the distribution of gender in the respondents? - What is the relationship between gender and BMI? - What is the relationship between gender and vigorous exercise? - What is the relationship between gender and fast food intake? - What is the relationship between gender and fruits and vegetable intake? - What is the relationship between gender and mandatory fitness standards? - What is the relationship between gender and deployment readiness? - What is the relationship between gender and access to care?	- Nominal - Nominal/scale - Nominal/ordinal - Nominal/ordinal - Nominal/ordinal - Nominal/nominal - Nominal/nominal - Nominal/nominal	Descriptive statistics: frequency distributions and measures of central tendency. Mann-Whitney U-test (nominal/ordinal) Wilcoxon signed ranks test (nominal/ordinal) Chi-square test of independence (nominal/nominal)
Race /ethnicity	What is your race?	- What is the distribution of race/ethnicity? - What is the relationship between race and BMI? - What is the relationship between race and vigorous exercise? - What is the relationship between race and access to care? - What is the relationship between race and mandatory fitness standards?	- Nominal - Nominal/scale - Nominal/ordinal - Nominal/nominal - Nominal/nominal	Descriptive statistics: frequency distributions and measures of central tendency. Mann-Whitney U-test (nominal/ordinal) Wilcoxon signed ranks test (nominal/ordinal) Kruskal-Wallis test (nominal/ordinal) Chi-square test of independence (nominal/nominal)

Table 2: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 SHRBAMP

Major Variable	Selected 2005 SHRBAMP Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
Branch of Service	What service are you in?	- What is the distribution of service branch in the respondents?	- Nominal	Descriptive statistics: frequency distributions and measures of central tendency.
		- What is the relationship between branch of service and BMI?	- Nominal/scale	
		- What is the relationship between service and vigorous exercise?	- Nominal/ordinal	Mann-Whitney U-test (nominal/ordinal)
		- What is the relationship between service and fast food intake?	- Nominal/ordinal	Wilcoxon signed ranks test (nominal/ordinal)
		- What is the relationship between service and mandatory fitness standards?	- Nominal/nominal	Kruskal-Wallis test (nominal/ordinal)
		- What is the relationship between service and deployment readiness?	- Nominal/nominal	Chi-square test of independence (nominal/nominal)
		- What is the relationship between service and access to care?	- Nominal/nominal	

Table 2: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 SHRBAMP

Major Variable	Selected 2005 SHRBAMP Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
Body Mass Index (BMI)	** Calculated variable ** About how tall are you without shoes on? (height) About how much do you weigh without shoes on? (weight)	- What is the distribution of the BMI in the respondents? - What is the relationship between BMI and vigorous exercise? - What is the relationship between BMI and fast food intake? - What is the relationship between BMI and fruits and vegetable intake? - What is the relationship between BMI and mandatory fitness standards? - What is the relationship between BMI and deployment readiness? - What is the relationship between BMI and access to care?	- Scale - Scale/ordinal - Scale/ordinal - Scale/ordinal - Scale/ordinal - Scale/nominal - Scale/nominal	Descriptive statistics: frequency distributions and measures of central tendency. Analysis of variance/ANOVA (scale/nominal) ** if the nominal is a yes/no, can use simple t-test. Spearman rank correlation (ordinal/nominal) ** will need to change the scale to ordinal and test correlation with nominal variable ** for ex: make the BMI ordinal instead of scale
Vigorous exercise	During the past 30 days, for leisure-time physical activity, how often (and for how long?) did you usually do each of the following? (vigorous activity described)	- What percent of respondents engaged in vigorous activity? - What is the relationship between vigorous exercise and mandatory fitness standards? - What is the relationship between vigorous exercise and deployment readiness? - What is the relationship between vigorous exercise and access to care?	- Ordinal - Ordinal/nominal - Ordinal/nominal - Ordinal/nominal	Descriptive statistics: frequency distributions and measures of central tendency. Mann-Whitney U-test (nominal/ordinal) Wilcoxon signed ranks test (nominal/ordinal) Kruskal-Wallis test (nominal/ordinal)

Table 2: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 SHRBAMP

Major Variable	Selected 2005 SHRBAMP Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
Fast-food intake	In average week, how often do you eat fast food?	- What is the relationship between fast-food intake and mandatory fitness standards? - What is the relationship between fast-food intake and deployment readiness? - What is the relationship between fast-food intake and access to care?	- Ordinal/nominal - Ordinal/nominal - Ordinal/nominal	Descriptive statistics: frequency distributions and measures of central tendency Mann-Whitney U-test (nominal/ordinal) Wilcoxon signed ranks test (nominal/ordinal) Kruskal-Wallis test (nominal/ordinal)
Fruits & vegetable intake	In an average week, how often do you eat fruit? In an average week, how often do you eat vegetables?	- What is the relationship between fruit and vegetable intake and mandatory fitness standards? - What is the relationship between fruit and vegetable intake and deployment readiness?	- Ordinal/nominal - Ordinal/nominal	Descriptive statistics: frequency distributions and measures of central tendency Mann-Whitney U-test (nominal/ordinal) Wilcoxon signed ranks test (nominal/ordinal) Kruskal-Wallis test (nominal/ordinal)
Mandatory fitness standards	Do you have difficulty meeting your service weight and/or body fat standard? Did you pass your most recent physical fitness test? Are you currently enrolled in a mandatory weight control/management program?	- What percent of respondents had difficulty meeting their service weight and/or body fat standards? - What percent of respondents passed their most recent physical fitness test? - What percent of respondents are currently enrolled in a mandatory weight control/management program?	- Nominal	Descriptive statistics: frequency distributions and measures of central tendency.

Table 2: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 SHRBAMP

Major Variable	Selected 2005 SHRBAMP Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
Deployment readiness	How many times have you been deployed in the past three years? How many days during the past 12 months have you been away from your permanent duty station? When were you last deployed? Did you serve with the military in any of the following areas?	- Describe the respondents' deployment frequency. - What is the relationship between deployment frequency and BMI?	- Nominal - Ordinal - Nominal/scale - Ordinal/scale	Descriptive statistics: frequency distributions and measures of central tendency Analysis of variance/ANOVA (scale/nominal)
Access to care	Assumption is made, answer default to yes.	For the purpose of this study, it will be assumed active duty members have access to health care. What is the relationship between access to care and BMI?	- Ordinal - Nominal - Nominal/scale	Descriptive statistics: frequency distributions and measures of central tendency. Analysis of variance/ANOVA (scale/nominal)

Table 3: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 BRFSS

Major Variable	Selected 2005 BRFSS Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
Age	What is your age?	-What is the mean age of the respondents? - What is the relationship between age and BMI? - What is the relationship between age and vigorous exercise? - What is the relationship between age and access to care?	- Scale - Scale/scale - Scale/ordinal or nominal or scale (depends on question) - Scale/nominal	Descriptive statistics: frequency distributions and measures of central tendency. Pearson product moment correlation (r) (scale/scale) Analysis of variance/ANOVA (scale/nominal) Spearman rank correlation (ordinal/nominal) ** will need to change the scale to ordinal and test correlation with nominal variable ** for ex: make the age ordinal instead of scale
Branch of Service	Have you ever served on active duty in the United States Armed Forces, either in the regular military or in a National Guard or military reserve unit? Which of the following best describes your service in the United States military? (can self-identify if they are on active duty status)	- What percent of respondents served in the military? - What is the relationship between those respondents who served in the military and BMI?	- Nominal - Nominal/scale	Descriptive statistics: frequency distributions and measures of central tendency Analysis of variance/ANOVA (scale/nominal)
Body Mass Index (BMI)	** Calculated variable** About how tall are you without shoes? (height) About how much do you	- What is the distribution of the BMI in the respondents? What is the relationship between BMI and vigorous exercise?	- Scale - Scale/ nominal or ordinal or scale (depends on exercise question)	Descriptive statistics: frequency distributions and measures of central tendency Analysis of variance/ANOVA (scale/nominal)

Table 3: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 BRFSS

Major Variable	Selected 2005 BRFSS Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
	weigh without shoes? (weight)	What is the relationship between BMI and ? What is the relationship between BMI and deployment readiness? - What is the relationship between BMI and access to care?	- Scale/ nominal or ordinal or scale (depends on exercise question) - Scale/nominal (assumed no) - Scale/nominal	Kruskal-Wallis test (nominal/ordinal) Pearson product moment correlation (r) (scale/scale) Spearman rank correlation (ordinal/nominal) ** will need to change the scale to ordinal and test correlation with nominal variable ** for ex: make the BMI ordinal instead of scale
Vigorous exercise	During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise? Thinking about the vigorous activities you do in a usual week, do do vigorous activities for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate? How many days per week do you do these vigorous activities for at least 10 minutes at a time? On days when you do vigorous activities for at least 10 minutes at a time, how	- What percent of respondents engaged in vigorous activity? - What is the relationship between vigorous exercise and BMI? - What is the relationship between vigorous exercise and access to care?	Nominal/ordinal/scale Nominal/ordinal/scale (depends on the exercise question) and scale Nominal/ordinal/scale and nominal	Descriptive statistics: frequency distributions and measures of central tendency. Analysis of variance/ANOVA (scale/nominal) Mann-Whitney U-test (nominal/ordinal) Wilcoxon signed ranks test (nominal/ordinal) Kruskal-Wallis test (nominal/ordinal) Chi-square test of independence (nominal/nominal) Pearson product moment correlation (r) (scale/scale)

Table 3: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 BRFSS

Major Variable	Selected 2005 BRFSS Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
	much total time per day do you spend doing these activities?			
Fast-food intake	No question			
Fruits & vegetable intake	How often do you eat carrots? Not counting juice, how often do you eat fruit? How often do you eat green salad? Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat?	- What percentage of respondents eat fruit daily? - What percentage of respondents eat fruit ___ # weekly? - What percentage of respondents eat ___ # vegetables weekly? - What is the relationship between fruit and vegetable intake and BMI?	- Nominal or ordinal - Scale/nominal or ordinal	Descriptive statistics: frequency distributions and measures of central tendency Analysis of variance/ANOVA (scale/nominal)
Mandatory fitness standards	No question			
Deployment readiness	No specific question about deployment.	- What percent of respondents served in the US Armed Forces? - What is the relationship between those who served and their BMI? - What is the relationship between those who did not serve and their BMI?	- Nominal - Nominal/scale - Nominal/scale	Descriptive statistics: frequency distributions and measures of central tendency. Analysis of variance/ANOVA (scale/nominal)
Access to care	Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare? Do you have one person you think of as your personal doctor or health care provider?	- What is the percentage of respondents who have health care…who do not? - What is the relationship of access to care and BMI?	- Nominal - Nominal/scale	Descriptive statistics: frequency distributions and measures of central tendency. Analysis of variance/ANOVA (scale/nominal

Table 3: Specific Aim 1: Descriptive Research Questions and Analytic Approach for 2005 BRFSS

Major Variable	Selected 2005 BRFSS Measures	Descriptive Research Questions	Level of Data	Data Analysis Approach
	Primary source of care? Availability of primary services? Availability of preventive services? Availability of Veterans health care?			

Table 4: Specific Aim 2: Relational Comparative Questions and Analytic Approach

Major Variable	Selected 2005 SHRBAMP Measures	Selected 2005 BRFSS Measures	Relational Comparative Research Questions	Level of Data	Data Analysis Approach
Age	Age at last birthday.	What is your age?	-What is the mean age of the respondents in each data set? - See Tables 2 & 3 for descriptive questions for each data set. - Which age group has the highest BMI? - Which age group does the most vigorous exercise? - How do the two groups differ as far as their age and vigorous exercise?	Scale (age) Ordinal (vigorous exercise)	Descriptive statistics: frequency distributions and measures of central tendency. Spearman rank correlation (ordinal/nominal) ** will need to change the scale to ordinal and test correlation with nominal variable ** for ex: make the age ordinal instead of scale
Gender	Are you male or female?	Indicate sex of respondent.	- What is the distribution of gender in the respondents in each data set? - See Tables 2 & 3 for descriptive questions for each data set. - Which group has the highest rates of BMI? - Which group has the highest frequency of vigorous exercise? - Who does more vigorous exercise, males or females?	Nominal (gender) Scale (BMI) Ordinal (vigorous exercise)	Descriptive statistics: frequency distributions and measures of central tendency. Analysis of variance/ANOVA (scale/nominal
Race /ethnicity	What is your race?	Which one of these groups would you say best represents your race?	- What is the distribution of race/ethnicity in each data set? - See Tables 2 & 3 for descriptive questions for each data set. - No specific comparison questions between both the groups.	Nominal (race and ethnicity)	Descriptive statistics: frequency distributions and measures of central tendency.
Branch of Service	What service are you in?	Have you ever served on active duty in the United States Armed Forces, either in the regular military or in a National Guard or military reserve unit? Which of the following best describes your service in the United States military? (can self-identify if they	- What is the distribution of service branch in the respondents? - What is the distribution of respondents who served in the military? - See Tables 2 & 3 for descriptive questions for each data set. - Does it make a difference in BMI in the non-military group if they did serve in the armed forces? - Would the BMI be lower if they served in the armed forces? - Will not be able to directly compare both data sets with this variable.	Nominal (branch of service) Scale (BMI)	Descriptive statistics: frequency distributions and measures of central tendency. Analysis of variance/ANOVA (scale/nominal)

Table 4: Specific Aim 2: Relational Comparative Questions and Analytic Approach

Major Variable	Selected 2005 SHRBAMP Measures	Selected 2005 BRFSS Measures	Relational Comparative Research Questions	Level of Data	Data Analysis Approach
		are on active duty status)			
Body Mass Index (BMI)	** Calculated variable ** About how tall are you without shoes on? (height) About how much do you weigh without shoes on? (weight)	** Calculated variable** About how tall are you without shoes? (height) About how much do you weigh without shoes? (weight)	- What is the distribution of BMI in each data set? - See Tables 2 & 3 for descriptive questions for each data set. - Compare the relationship between BMI and vigorous exercise military to non-military? Is there a significant difference?	Scale (BMI) Ordinal (vigorous exercise)	Mann-Whitney U will be used to examine relationships between two group variables when the dependent variable is ordinal. Kruskal-Wallis will be used to examine relationships between k group level variables when the dependent variable is ordinal. Spearman rank correlation (ordinal/nominal) ** will need to change the scale to ordinal and test correlation with nominal variable ** for ex: make the age ordinal instead of scale
Vigorous exercise	During the past 30 days, for leisure-time physical activity, how often (and for how long?) did you usually do each of the following? (vigorous activity described)	During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise? Thinking about the vigorous activities you do in a usual week, do you do vigorous activities for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate?	- See Tables 2 & 3 for descriptive questions for each data set. - Compare the relationship between BMI and vigorous exercise military to non-military? Is there a significant difference?	Ordinal (vigorous exercise) Scale (BMI)	Spearman rank correlation (ordinal/nominal) ** will need to change the scale to ordinal and test correlation with nominal variable ** for ex: make the age ordinal instead of scale Could consider changing the SHRBAMP level of measurement for vigorous exercise to nominal (yes/no) and compare to BRFSS yes/no. Then, look at additional BRFSS questions about frequency and intensity and compare to SHRBAMP. Chi-square test of independence (nominal/nominal) 2X2 cross table

Table 4: Specific Aim 2: Relational Comparative Questions and Analytic Approach

Major Variable	Selected 2005 SHRBAMP Measures	Selected 2005 BRFSS Measures	Relational Comparative Research Questions	Level of Data	Data Analysis Approach
		How many days per week do you do these vigorous activities for at least 10 minutes at a time? On days when you do vigorous activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?			
Fast-food intake	In average week, how often do you eat fast food?	No question	- See Table 2 for descriptive questions for military data set. - Unable to compare the two data sets with fast-food intake variable.	Ordinal (SHRB)	Descriptive statistics: frequency distributions and measures of central tendency
Fruits & vegetable intake	In an average week, how often do you eat fruit? In an average week, how often do you eat vegetables?	How often do you eat carrots? Not counting juice, how often do you eat fruit? How often do you eat green salad? Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat?	- See Tables 2 and 3 for descriptive questions for each data set. - Will not directly compare data sets to each other for fruits and vegetables.	Ordinal	Descriptive statistics: frequency distributions and measures of central tendency.
Mandatory fitness standards	Do you have difficulty meeting your service weight and/or body fat standard? Did you pass your most recent physical fitness test?	(If in Reserves or Guard, can assume they have mandatory fitness standards.) If they are not in the Reserves or Guard, we assume they do not	- See Tables 2 and 3 for descriptive questions for each data set. - **Assumption made** that military has mandatory fitness standards and non-military do not. Does it make a difference in their BMI rates?	Nominal	Descriptive statistics: frequency distributions and measures of central tendency.

Table 4: Specific Aim 2: Relational Comparative Questions and Analytic Approach

Major Variable	Selected 2005 SHRBAMP Measures	Selected 2005 BRFSS Measures	Relational Comparative Research Questions	Level of Data	Data Analysis Approach
	Are you currently enrolled in a mandatory weight control/management program?	have mandatory fitness standards.			
Deployment readiness	How many times have you been deployed in the past three years? How many days during the past 12 months have you been away from your permanent duty station? When were you last deployed? Did you serve with the military in any of the following areas?	Have you ever served on active duty in the United States Armed Forces, either in the regular military or in a National Guard or military reserve unit?	- See Tables 2 & 3 for descriptive questions for each data set. - **Assumption made** that military has deployment readiness risk and non-military do not. Does it make a difference in their BMI rates?	Nominal	Descriptive statistics: frequency distributions and measures of central tendency.
Access to care	Assumption is made, answer default to yes.	Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare? Do you have one person you think of as your personal doctor or health care provider? Primary source of care? Availability of primary services? Availability of preventive services?	- See Tables 2 & 3 for descriptive questions for each data set. - **Assumption made** that military has deployment readiness risk and non-military do not. Does it make a difference in their BMI rates?	Nominal (access to care) Scale (BMI)	Descriptive statistics: frequency distributions and measures of central tendency. Analysis of variance/ANOVA (scale/nominal)

Table 4: Specific Aim 2: Relational Comparative Questions and Analytic Approach

Major Variable	Selected 2005 SHRBAMP Measures	Selected 2005 BRFSS Measures	Relational Comparative Research Questions	Level of Data	Data Analysis Approach
		Availability of Veterans health care?			

References

Adams, K., Schatzkin, A., Harris, T., Kipnis, V., Mouw, T., Ballard-Barbash, R., Hollenbeck, A. Leitzmann, M. (2006). Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *New England Journal of Medicine,* 355, 763-778.

Basu, S. (2004). Military not immune from obesity 'epidemic'. US Medicine: The voice of federal medicine. Retrieved July 30, 2006,from http://www.usmedicine.com

Basu,S. (2003). Surgeon General calls obesity 'threat' as real as WMD. Retrieved January 3, 2007 from http://www.usmedicine.com/article

Bibb, S. (2007). Issues associated with secondary analysis of population health data. *Applied Nursing Research,* 20, 94-99.

Bray, R., Olmsted, K., Williams, J., Sanchez, R., & Hartzell. (2006). Progress toward *Healthy People 2000* objectives among U.S. military personnel. *Preventive Medicine, 42*, 390-396.

Brug, J., Lenthe, F., & Kremers, S. (2006). Revisiting Kurt Lewin: How to gain insight into environmental correlates of obesogenic behaviors. *American Journal of Preventive Medicine, 6*, 525-529.

Burns, N., & Grove, S. (2005). *The practice of nursing research: Conduct, critique, and utilization.* Philadelphia: WB Saunders.

Castle, J. (2003). Maximizing research opportunities: Secondary data analysis. *Journal of Neuroscience Nursing,* 35, 287-290.

Clark, S. & Cossette, A. (2000). Secondary analysis: theoretical, methodological, and practical considerations. *Canadian Journal of Nursing Research,* 32, 109-129.

Conner, M. & Norman, P. (1996). *Predicting Health Behavior. Search and Practice with Social Cognition Models.* Open University Press: Baltimore: Buckingham.

Cornell University, College of Veterinary Medicine. (2007). Program on breast cancer and environmental risk factors. Retrieved on February 9, 2007 from http://environcancer.cornell.edu/obesity/background.cfm

Egger, G., Swinburn, B., & Rossner, S. (2003). Dusting off the epidemiological triad: could it work with obesity? *The International Association for the Study of Obesity, 4*, 115-119.

Fawcett, J. (2004). Contemporary nursing knowledge: Analysis and evaluation of nursing models and theories (2nd ed.). Philadelphia: F.A. Davis.

Ferraro, K., Su, Y., Gretebeck, R., Black, D., & Badylak, S. (2002). Body mass index and disability in adulthood: a 20-year panel study. *American Journal of Public Health, 92,* 834-840.

Flegal, K. (2006). Body mass index of health men compared with healthy women in the United States. *International Journal of Obesity,* 30-374-379.

French, S., Story, M., & Jeffery, R. (2001). Environmental influences on eating and physical activity. *Annual Review of Public Health, 22*, 309-335.

Friedl, K. E., & Bathalon, G. P. (2006). Body composition standards to prevent obesity in the military. *Mil Med, 171*(6), vi.

Haley, G. (2006). An introduction to using data at DPLS. *Electronic Data Service.* Retrieved from www.dpls@mailplus.wisc.edu on August 2, 2006.

Hawkins, S., Cockburn, M., Hamilton, A. & Mack, T. (2004). An estimate of physical activity prevalence in a large population-based cohort. *Medicine & Science in Sports & Exercise.* Retrieved from http://www.acsc-msse.org on February 7, 2007.

Institute of Medicine of the National Academies. *Weight Management: State of the science and opportunities for military programs.* National Academies Press: Washington, D.C.

Janssen, I., Katzmarzyk, P., & Ross, R. (2004). Waist circumference and not body mass index explains obesity-related health risk. *American Journal of Clinical Nutrition*, 79, 379-384.

Kress, A., Hartzel, M., & Peterson, M. (2004). Burden of disease associated with overweight and obesity among U.S. military retirees and their dependents, aged 38-64, 2003. *Preventive Medicine, 41*, 63-69.

Magee, T., Lee, S., Giuliano, K. & Munro, B. (2006). Generating new knowledge from existing data: The use of large data sets for nursing research. *Nursing Research,* 55, S50-S56.

Mullis, R., Blair, S., Aronne, L., Bier, D., Denke, M., Dietz, W., Donato, K., Drewnowski, A., French, S., Howard, B., Robinson, T., Swinburn, B. & Wechsler, H. (2004). Obesity, a worldwide epidemic related to heart disease and stroke Group IV: Prevention/Treatment. (2004). *Circulation,* 110, 484-488.

Munro, B. (2005). *Statistical Methods for Health Care Research.* (5th ed.). Philadelphia: Lippincott Williams & Wilkins.

Nieto-Garcia F., Bush T. & Keyl P. (1990). Body mass definitions of obesity: sensitivity and specificity using self-reported weight and height. *Epidemiology* 1:146-152.

Paris, R., Bedno, S., Krauss, M., Keep, L., & Rubertone, M. (2001). Weighing in on type 2 diabetes in the military. *Diabetes Care. 24*, 1894-1898.

Pereira, M., Ebbeling, C., Van Horn, L., Slattery, M., Jacobs, D. & Ludwig, D. (2005). Fast-food habits, weight gain, and insulin resistance (the CARDIA study): 15-year prospective analysis. Retrieved on February 20, 2007 from www.thelancet.com

Pleis, J. & Lethbridge, M. (2005). Summary health statistics for U.S. adults: National health interview survey, 2005. *Vital Health Statistics,* 232, 1-153.

Poston, W., Haddock, C., Peterson, A., Vander Weg, M., Klesges, R., Pinkston, M., & DeBon, M. (2004). Comparison of weight status among two cohorts of US Air Force recruits. *Preventive Medicine, 40*, 602-609.

Prentice, A. & Jebb, S. (1995). Obesity in Britain: gluttony or sloth? *British Medical Journal.* 311, 437-439.

Riley, D., Wingard, D., Morton, D., Nichols, J., Ji, M., Shaffer, R. & Macera, C. (2005). Use of self-assessed fitness and exercise parameters to predict objective fitness. *Medicine & Science in Sports & Exercise,* 37, 827-831.

Robbins, A., Chao, S., Fonseca, V., Snedecor, M., & Knapik, J. (2001). Predictors of low physical fitness in a cohort of active-duty U.S. Air Force members. *American Journal of Preventive Medicine, 20*, 90-96.

Robbins, A., Chao, S., Baumgartner, N., Runyan, C., Oordt, M. & Fonseca, V. (2006). A low-intensity intervention to prevent annual weight gain in active duty Air Force members. *Military Medicine,* 171, 556-561.

Sakuta, H., & Suzuki, T. (2006). Physical activity and selected cardiovascular risk factors in middle-aged male personnel of self-defense forces. *Ind Health, 44*(1), 184-189.

Shepard, M., Carroll, R., Mahon, M., Moriarty, H., Feetham, S. & Deatrick, J. (1999). Conceptual and pragmatic considerations in conducting a secondary analysis. An example from research of families. *Western Journal of Nursing Research,* 21, 154-167.

Smaldone, A. & Connor, J. (2003). The use of large administrative data sets in nursing research. *Applied Nursing Research,* 16, 205-207.

Steinkraus, L., Cayce, W. & Golding, A. (2003). Diabetes mellitus type 2 in aviators: A preventable disease. Aviation, Space, and Environmental Medicine, 74, 1091-1101.

Tabachnick, B. & Fidell, L. (2001). *Using multivariate statistics (4th ed.).* New York: HarperCollins College Publishers.

U.S. Department of Health and Human Services. (2006). *The Surgeon General's call to action to prevent and decrease overweight and obesity.* Rockville, MD: GPO, Washington.

Why are some people obese: Trends in obesity research. (n.d.) Retrieved January 3, 2007 from http://www.obesityinamerica.org/whyobesity.html

Wynd, C., & Ryan-Wenger, N. (1998). The health and physical readiness of army reservists: a current review of the literature and significant research questions. *Military Medicine, 163*, 283-287.

Uniformed Services University
of the Health Sciences

Manuscript Approval or Clearance*

INITIATOR

USU Principal Author: Julie M. Bosch, Major, USAF, NC

1. Academic Title: Maj Bosch-PhD candidate in the Graduate School of Nursing, Family Nurse Practitioner,
2. School/Department: USUHS, Graduate School of Nursing
3. Phone: (301)-295-9004
4. Type of Publication (submitted to): Paper Article ✓ Book Chapter
   USU WWW Home Page at (location): None
   Other: None
5. Manuscript title: Body Mass Index and Physical Activity in the Military Environment
6. Intended publication (include organization if appropriate): *Military Medicine*
7. Required by (publication receipt) date: 30 January 2008
8. Date submitted for USU approval: 2 Jan 2008

CHAIR OR DEPARTMENT HEAD APPROVAL

1. Name: Sandra Garmon-Bibb, DNSc, RN
2. School/Department: USUHS, Graduate School of Nursing
3. Date: 9 January 2008
4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).
   ***Note:** *It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*
5. ☑ Chair / Department Head Approval

Sandra C. BSS - Dissertation Chair 1/9/08
Chair / Department Head Approval/Date

(If approval or clearance is required, see other side of form)

DEAN APPROVAL

1. Name: Bruce A. Schoneboom, CRNA, PhD COL, AN, Acting Dean, GSN

2. School/Department: USUHS, Graduate School of Nursing

3. Date: _____

4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).
   ***Note:** *It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*

5. ☑ Dean Approval

9 Jan 08

Dean Signature/Date

OUA APPROVAL

1. Name: Carol Scheman

2. Date: 10 Jan. 08

3. ☑ USU Approved or
   ☐ DoD approval/clearance required

4. ☐ Submitted to DoD (Health Affairs) on (date): _____
   or
   ☐ Submitted to DoD (Public Affairs) on (date): _____

5. DoD approved/cleared (as written) or ☐ DoD approved/cleared (with changes)

6. DoD clearance/date: _____

7. DoD disapproval/date: _____

Director, OUA Signature/Date

Manuscript #2

You have successfully submitted your manuscript via the Rapid Review system. 1/14/08

Your Manuscript Number (MS #) is: MM-0021-08, Version 1

Take note of these numbers for future reference.
You can log on to Rapid Review at any time to see the current status of your manuscript(s).

If you wish to contact the journal office, here's how:

Military Medicine
9320 Old Georgetown Road
Bethesda, MD 20814

Phone: 301-897-8800
FAX: 301-530-5446
Email: milmed@amsus.org

Thank You for Using the Rapid Review System!

OK

RUNNING HEAD: Body Mass Index and Physical Activity

Body Mass Index and Physical Activity in the Unique Military Environment

Corresponding Author
First Author
Julie M. Bosch, Maj, USAF, NC,
Uniformed Services University of the Health Sciences
Graduate School of Nursing

Guarantor
Second Author
Sandra C. Bibb, DNSc, RN
CAPT (ret), USN, NC
Uniformed Services University of the Health Sciences
Graduate School of Nursing

Abstract

The uniqueness of the military environment (universal access to care, fitness standards, and deployment requirements) may no longer be enough to sustain military members within “normal weight” standards. Similarities in trends of overweight between military members and non-military cohorts suggest that differences in military and non-military environments may be eroding. Results from the 2005 Survey of Health Related Behaviors among Military Personnel indicate that despite high rates of self-reported vigorous exercise, *pre-obesity* in military personnel is *higher* than in non-military cohorts. Environmentally based conceptual frameworks are needed to study this problem and gain insight into the trend in concomitant increasing body mass index and vigorous physical activity in military members. The purpose of this article is to lay the foundation for this research by presenting a review of the literature on body mass index and physical activity in military personnel, and an overview of unique aspects of the military environment.

Introduction

The 2005 Department of Defense (DoD) Survey of Health Related Behaviors Among Military Personnel (SHRBAMP) results were published in January 2007 and concluded that overweight or *pre-obesity* in military personnel is now *higher* than in the non-active duty population.[1] According to this survey and consistent with the nationwide trend, 'overweight' based on body mass index (BMI), increased from 51.2 % in 1995 to 61.6 % in 2005 for active duty members aged 20 or older.[1-4] (Fig. 1) Surprisingly, these results parallel a concurrent increase in strenuous exercise consistent with the military's emphasis on physical fitness.[5] The concomitant increase in BMI and strenuous exercise in active duty personnel elucidate the reality that "overweight" originates from numerous factors. Strenuous physical activity alone cannot sustain a "within normal standards" BMI.[6]

The nation's epidemic of overweight and obesity (as measured by BMI) affects the military services of the United States in many ways. This epidemic has a direct effect on retention of new recruits, in that, almost 80% of military recruits who exceed BMI standards at enlistment, leave the service before completing their first term.[7] In a study published in 2007, Yamane [8] measured the prevalence of obesity in the adult civilian population using data from the National Health and Nutrition Examination Survey (NHANES) for the years 2001-2004. The results showed that 17.9% to 54.5% of men and 20.8% to 54.9% of women were considered overweight, and therefore ineligible for military enlistment. The military is now a stakeholder in the worsening public health issue of increasing weight in the civilian population. Furthermore, military personnel with increased BMI are at increased risk for disease co-morbidities related to being

overweight and increased morbidity among active duty personnel can affect troop retention and threaten the military's operational readiness.

The 'disconnect' between increased vigorous physical activity and increasing BMI is not a new revelation. Numerous research studies underscore the importance of healthy eating and exercise in minimizing body fat and avoiding the state of "being overweight". The majority of these studies are founded on conceptual frameworks and theories based on health beliefs and health behaviors as motivators for change and maintenance of BMI within normal limits. Within the military, health beliefs and behaviors are a very important part of framing health and fitness for many military members. However, military operational readiness is predicated on framing within a unique military environment.

If greater insight is to be gained into the concomitant increase in BMI and strenuous exercise in active duty personnel, the epidemic of overweight and obesity (as measured by BMI) must be viewed through a lens that explores the potential impact of military environmental factors. The SHRBAMP was initiated to collect data related to health behaviors of military personnel. However, the assumptions under girding the questions in the survey (universal access to health care, physical fitness standards, and deployment requirements), and the unique environment from which the population sample is drawn, create an ideal venue for examining the relationship between body mass index and physical activity in an active duty population, using a framework that incorporates aspects of the military environment. The purpose of this article is to present a review of the theoretical and empirical literature regarding trends in body mass index and physical activity in the military population; and an overview of unique

aspects of the military environment. It is expected that this article will lay the foundation for developing and using environmentally based conceptual frameworks to study the trend in simultaneous increased body mass index and vigorous physical activity in military members.

2005 SHRBAMP and *Healthy People* Objectives

The DoD SHRBAMP surveys are cross-sectional and designed to represent active-duty service members from all branches of the military stationed worldwide. The SHRBAMP is conducted every 3 years and has been used by the DoD to track changes in health behaviors. The survey was initiated in 1980 and the 2005 survey, the 9th in the series, expanded to include National Guard and Reserve military members. The SHRBAMP is sponsored by the Office of the Assistant Secretary of Defense and the 2005 sample size was approximately 16,000 military service members from all branches. Primarily, data were collected from participants in group sessions on military installations. The 2005 survey was a self-administered paper-and-pencil questionnaire and contained measures regarding self-reported specific health risk behaviors.

The 2005 SHRBAMP also assessed the national health status goals from the *HP 2010* objectives. *Healthy People (HP) 2000 and 2010* present comprehensive and nationwide health promotion and disease prevention agendas that are grounded in science built through public consensus, and designed to measure progress. [9] Despite nation-wide interest in *HP 2000* and *2010* objectives, there are relatively few published studies that have examined the *HP* objectives with regards to military personnel. One published study reported progress toward the *Healthy Behavior 2010* 'physical exercise' objective across all active-duty services as measured by the 1995, 1998, and 2002 DoD

SHRBAMP. [8] A *Healthy People* 2010 objective is that greater than 30% of Americans will engage in vigorous physical activity at least three times a week. The 2002 DoD SHRBMP results reported that 70% of military personnel met this objective. In 2005, the definition of "vigorous exercise" was redefined; but the results remained high at 57.6%, far exceeding *HP* 2010 goals.

Self-reported regular physical fitness and strenuous exercise increased in all the services, consistent with the military's emphasis on fitness. However, despite the high rates of self-reported vigorous exercise, the military is far from meeting the *HP* 2010 Healthy Weight objective. Healthy weight is defined as a body mass index in the range of 18.5% - 25.0%. The military had only 40% of its personnel meet this criterion, which is far below the *HP* objective of 60%.

Body Mass Index

Body Mass Index (BMI) is a measurement derived from a person's height and weight. BMI is a simple and cost-effective screening method because it is highly correlated with measures of body fat.[10] A substantial body of evidence shows the positive association between BMI and morbidity/mortality.[7] Overweight is defined as a BMI greater than 25.0 and class I obesity is a BMI of 30.0 or more. Self-reported heights and weights can under-estimate obesity prevalence, but are considered accurate and acceptable for epidemiologic surveys and are commonly used in national surveys.[11, 7] The addition of waist circumference to BMI predicts a greater variance in health risk than BMI alone, but whether the reverse is true is unclear.[12]

The 2005 SHRBAMP results illustrated that 77.1% males (35 years and older) in the Air Force are overweight and 21% are obese. The Army's BMI statistics are

virtually identical to the Air Force. The Navy's current rate of overweight males ages 35 and older, is the highest of all the services, at 80.1%, with 23.1% obese. The BMI results have increased every year since the DoD survey was initiated in 1980, capping off at an all-time high in 2005 for all services.

Although BMI is the most practical assessment for use in large surveys, it is only one measure used by the military. Most of the military services (excluding Air Force) use BMI as a screening measure only, and if the service member's BMI exceeds the standards for their branch of service, their body fat percentage is measured. Overall, BMI has proven to be a practical and accurate tool to measure a recruit's fitness for military service for almost 150 years.[7] The very first height and weight tables for the U.S. military were actually initiated during the Civil War.

In a study by Adams and Schatzkin[13] published in the *New England Journal of Medicine,* the authors reiterated that obesity (BMI $\geq$ 30.0) is associated with an increased risk of death. However, the relationship between being overweight (BMI of 25.0–29.9) and an increased risk of death had not been as extensively studied. This study prospectively examined BMI in relation to the risk of death from any cause, in approximately 525,000 U.S. males and females from the National Institute of Health (NIH)-AARP cohort, between the ages of 50-71. During the follow-up period of ten years, analyses showed an increased risk of death in *both* overweight and obese subjects. In analyses of BMI during midlife (age 50), among those who had never smoked, the associations with the risk of death increased by 20-40% among overweight persons. This trend suggests long-term effects on morbidity and mortality risk, as well as soaring future health care costs in the DoD.

Physical Activity

Physical activity represents the individual's energy expenditure. Reductions in physical activity due to modernized and industrialized societies, have likely contributed to positive energy balance and weight-gain. Among adults who have successfully maintained weight loss over time, a common factor is increased physical activity.[7] The majority of military members reported high rates of vigorous physical exercise (56%-73%) in the SHRBAMP, yet the rates of being overweight based on BMI were at an all-time high of 61%. It is possible that military members inflate their self-reported physical activity frequency, as well as their exercise intensity.

The effects of physical activity on weight and health may be influenced by age. In a 2004 study[14], (http://www.acsc-msse.org) the purpose was to describe the prevalence of moderate and vigorous physical activity among 40,000 native Californians in relation to age, gender, education, and self-reported disease risk factors. The relationship between demographic variables, chronic disease risk factors, and meeting physical activity (PA) guidelines was analyzed. Significant age and education gradients existed for both moderate and vigorous PA. An inverse association was noted between both moderate and vigorous physical activity and prevalence of chronic disease risk factors. This study could have implications for more effective targeting of PA guidelines of U.S. adults, including those serving in the military. In contrast to the 2005 SHRBAMP results, only 22.3% of the total group reported moderate amounts of PA (according to CDC and ACSM guidelines) and 37.4% reported vigorous amounts of PA. These results suggest that despite vigorous physical activity, the military's overweight personnel are starting to match their non-military countrymen. Sakuta & Suzuki[15]

conducted a cross-sectional analysis of the association between duration of physical activity and the presence of cardiovascular risk factors in middle-aged male personnel of the Self-Defense Forces during a routine retirement check-up. Their results showed that duration of high intensity physical activity (not moderate or low intensity), inversely correlated with BMI, triglyceride and glucose levels, as well as blood pressure. Numerous studies have reported similar findings, that physical activity may reduce the incidence of chronic diseases by favorably altering blood lipid profiles, reducing body fat, and improving lean body mass.[7]

Another possible reason for the increased rates of increased BMI is the significant change in eating habits and exercise during the past 20 years. The military population has not been immune to those shifts. Some of these changes are in food availability and composition (increased fast-food consumption), and technological changes that greatly decrease physical movement and activity. This reduction in physical activity is inherent to the current modern military, with more jobs reflecting a sedentary emphasis as opposed to years past.

Riley et al[16] conducted a prospective study to examine the effectiveness of self-assessed fitness and exercise in predicting objectively measured physical fitness. The 1,583 male subjects (entering the Marine Corp) completed a questionnaire and an objective fitness test. Multivariate modeling found numerous measures of self-assessed fitness were all associated with the objective fitness score. If the subjects self-assessed a high level of fitness, this correlated with a high score on a fitness test. The 2005 SHRBAMP also collected data about self-assessed levels of fitness and the service members' satisfaction with their current weight.

Military Environment

Healthy body weight is an extremely complex issue. Maintenance of fitness and appropriate BMI by military personnel is affected by each person's genetics, physiology, age, physical activity level, diet, environment, and social background. Some of these factors are biologically programmed; the individual can manipulate others, while other factors require environmental changes.[7] The environment incorporates physical, economic, and sociocultural aspects of a population. There are unique factors in the military environment that do not exist in a non-military environment, such as access to health care, mandatory physical fitness standards, and an expected readiness for deployment. These factors may have been relied on in the past to protect military service members from an increased BMI, but the results from the 2005 SHRBAMP illustrate that the military is not projected to meet the *HP 2010* objective of maintaining a healthy weight. Despite the unique military environment, BMI levels are steadily increasing in the military population, despite vigorous physical activity.

Currently, the military population is projected to meet only 37% of the 19 *HP 2010* objectives. The areas of success in meeting the *HP 2010* objectives are those for which military regulations ensure compliance with the healthy desired behaviors. These areas are exercise, obesity, seat belt use, and helmet use. Fitness standards and regulations dictate that military members exercise regularly and do not become obese. Even so, why are so many service members overweight? The military environment is changing and the unique factors relied on to protect service members from being overweight in the past, may no longer be sufficient. Perhaps the cultural dividing line between military and non-military populations is eroding.

Environmentally based conceptual frameworks may provide insight into this trend in concomitant increasing body mass index and vigorous physical activity in military members, and provide a framework to compare military populations to non-military populations. An overview of aspects of the unique military environment that include access to health care, mandatory fitness standards, and deployment requirements are presented below.

Access to health care

Access to quality health care is paramount in the military population, in that service members should receive effective health services when and where needed.[17] This access has numerous components, two of which are financial and structural access. Financial access relates to aspects of health insurance coverage. Structural access relates to the availability of services and health care providers. The processes of entry into and utilization of health care services are closely related to structural and financial access to health care.[18-19] However, structural and financial access to health care does not guarantee entry into and utilization of health care services.

Personal barriers to access impact utilization of health services even when structural and financial access to care are present. Military service members' recognition of needs for services and their decisions to seek health care are generally the first step in the process of accessing services. In addition, the perceived necessity, availability, and appropriateness of health care services provided to military members structurally and financially, may influence utilization of services. Perception is defined as the selection and organization of information assessed through the human senses and interpreted within the individual's cultural belief and value system. Therefore, in

addition to economic factors, a perception of availability of health care is influenced by location of care, fit with personal time schedules, fit with personal responsibilities, and fit with cultural beliefs, values, and expectations. A perception of the necessity of care is influenced by incorporation of definitions of health, presence and severity of symptoms, and personal and family priorities. A perception of appropriateness of care is influenced by the suitability of health care in relation to cultural values and beliefs, health practices, and previous experiences associated with health care.[20]

Classically, culture is defined as "the learned, shared, and transmitted values, beliefs, norms, and life way practices of a particular group that guides their thinking, decisions, and actions, in patterned ways".[21] Military members emerge from family cultures, live in American culture, and work in a military culture with values, beliefs, norms, and life way practices that are intended to guide thinking, decisions, and actions in patterned ways. One patterned way relates to "normal weight". With the current similarities in trends in overweight and obesity between military members and their non-military cohorts, questions arise related to the influence of American cultural norms on military members, as compared to the intended influence of military cultural values, beliefs, and practices.

Clearly, there is a relationship between access to health care and utilization of health care services, but the concept of access to care is complex and multifaceted. How does structural and financial access to health care influence health behaviors and health practices of military members living in the American culture? Are there differences in rates of BMI between two different American culture populations engaged in vigorous physical activity when one group has universal financial and structural

access to care and the other group does not? Environmentally based conceptual frameworks that incorporate comparison of the potential impact of access to health care in military and non-military populations may provide some insight into these relationships.

Mandatory fitness standards

Physical fitness requirements are a unique component of the military environment. Most non-military occupations do not mandate annual fitness testing or openly encourage a vigorous physical activity program. The military's fitness requirements were originally predicated on the need for the highest level of physical performance in adverse environments. Body weight and fitness standards theoretically take precedent even when a military member performs their assigned duties in an exceptional manner.[7]

Each branch of the U.S. armed forces has unique standards for physical fitness and weight standards, as well as programs and policies in place, to ensure compliance with these standards.[22] In early 2004, the Air Force instituted a health based fitness assessment and screening test to determine if personnel were physically fit. Programs that integrated physical fitness activities into duty time and work routines were highly encouraged. The Air Force no longer solely measures "fatness", (weighing its members, measuring BMI) but rather measures "fitness" (waist circumference, a timed 1.5 mile run, and calisthenics).

Army service members maintain their physical fitness levels to complete their arduous mission of ground troop support. These members are required to take a physical fitness test at least twice per year composed of push-ups, sit-ups, and a timed

two-mile run. Navy physical readiness tests are conducted twice each year and include height, weight, and body fat measurements. The test, similar to the other services, measures flexibility, aerobic capacity and muscular endurance. However, these new fitness programs and annual fitness evaluations may not ensure a fit and ready force.

Even though fitness standards and mandatory testing exist, these requirements do not automatically translate into maintaining physical fitness all year round. Members are fit tested once or twice per year, but what about the other 364 days? Individuals may have their own *personal* fitness standards, which may or may not align with the military "cultural" expectations of fitness. Military members' personal standards differ as radically as the individuals themselves.

Immersed in American culture and living outside of the military gates facilitates a more blended environment for military members. With a fast food establishment on every corner and the daily tempo at a rapid pace, making healthy food choices can be challenging. How do mandatory fitness standards influence the health behaviors of military service members who live in the American culture? Are there differences in rates of BMI between two different American culture populations engaged in vigorous physical activity when one group has mandatory physical fitness standards and the other group does not? Environmentally based studies should address these questions in the near future.

Deployment readiness

A third unique component of the military environment is an expected readiness for deployment. Combat readiness through enhanced physical fitness is a major emphasis in the United States military.[23] The deployed service member is expected to

be physically fit and at optimal health. But is this depiction realistic or even relevant as it was in previous wars? All military personnel are potentially needed during armed conflicts and even those individuals in occupations of a sedentary nature need to be physically prepared. During peacetime, there are numerous occupational jobs that are technical and require highly trained individuals, but may not be physically demanding. However, during wartime, a service member's physical strength and endurance may be tested and until this risk of deployment changes, all military personnel must stand ready to deploy.

The deployment readiness of military personnel is an important attribute that directly influences the effectiveness of the military organization and the outcomes of the mission. One of the three tenets of Force Health Protection is to recruit and maintain a healthy and fit force. As stated, the number of young adults who are eligible for military service but are overweight or obese, is increasing. This presents a recruitment challenge, because all services have weight, fitness and maintenance requirements.[11] Once a member enlists and enters boot camp, they are immersed in a controlled environment that is completely focused on strict military training, deployment readiness, and maintaining a healthy weight.

Following boot camp, recruits leave the controlled training culture and are released back to various unhealthy aspects of American culture, even though they work in military settings. If a military member is expected to maintain readiness for deployment, he/she needs to maintain a healthy weight in order to succeed in the mission. Do deployment readiness requirements influence health behaviors and health practices of military members living in the American culture?

The core values of the military guide beliefs and practices related to service and country, and readiness for deployment. An overweight military does not equate to success on the battlefield. However, little is known about the influence of the American cultural environment on readiness for deployment in military members as compared to the non-military culture.

Future recommendations

Several studies have reported that success rates for maintaining weight loss have been low; leading obesity experts to argue the single most effective approach is prevention.[22] Naghii[24] concurred and concluded that preventing obesity or treating it in the initial stages was more effective than any attempts to lose weight. The limited effect of health education on weight loss has initiated a shift from personal factors to environmental factors regarding eating behaviors and physical activity levels.

In a (2006) study, Brug[25] conducted six systematic literature reviews of environmental correlates and interventions for weight-related eating behaviors and physical activity for both children and adults. The review of 297 observational studies illustrated few studies of environmental associations have been replicated. The researchers argued that better-designed and vigorous research on the true importance of environmental factors for obesogenic behavioral change is needed.

If the military populations' increased BMI is associated with environmental factors, current and future research should focus on proposed environmental changes, in addition to the individual's health behavior choices.[26] Endocrine scientists assert that an environmental model may be a more comprehensive way to study increased BMI rather than traditional health belief models or energy balance models. Egger and Swinburn[27]

suggested many years ago that obesity should be regarded as a normal response to an abnormal environment.

A new era of research about methods that measure exercise and eating behavior associated with environmental factors is clearly needed.[28] The overweight military population has been traditionally targeted via behavioral weight loss programs, both individual and group. It is time to change the research approach of weight management issues and evaluate the environment as an important factor. Research focusing on military personnel should explore the view of environment, past the "virtual" walls of military culture to include an environmental focus that includes aspects of American culture. It is no longer sufficient to study the military population in isolation from their civilian counterparts.

There is a wealth of rich and pertinent data available to researchers from the past DoD Surveys of Health Related Behaviors among Military Personnel. Researchers should compare the military population to the non-military population, as these cultures once perceived as being quite different from one another; now appear to have much in common regarding the obesity epidemic. The military population cannot rely on unique environment factors, such as universal access to care, physical fitness standards, and deployment readiness to prevent a military overweight epidemic in an obesogenic environment.

References

1. Survey of Health Related Behaviors among Military Personnel. (2005). Department of Defense. Executive summary.

2. Survey of Health Related Behaviors among Military Personnel. (1995). Department of Defense. Executive summary

3. Survey of Health Related Behaviors among Military Personnel. (1998). Department of Defense. Executive summary

4. Survey of Health Related Behaviors among Military Personnel. (2002). Department of Defense. Executive summary

5. Bray R, Olmsted K, Williams J, Sanchez R, Hartzell: Progress toward *Healthy People 2000* objectives among U.S. military personnel, *Prev Med* 2006; *42:* 390-96.

6. Prentice A, Jebb S: Obesity in Britain: gluttony or sloth? *BMJ 2006;* 311: 437-39.

7. Institute of Medicine of the National Academies. *Weight Management: State of the science and opportunities for military programs.* 2003. National Academies Press: Washington, D.C.

8. Yamane G: Obesity in civilian adults: Potential impact on eligibility for U.S. military enlistment. *Milit Med* 2007; 172: 1160-65.

9. U.S. Department of Health and Human Services. Healthy People 2010: Understanding and Improving Health. 2nd ed. Washington, DC: U.S. Government Printing Office, November 2000.

10. U.S. Department of Health and Human Services: *The Surgeon General's call to action to prevent and decrease overweight and obesity.* 2006; Rockville, MD: GPO, Washington.

11. Poston W, Haddock C, Peterson A, Vander Weg M, Klesges, R, Pinkston M, DeBon, M: Comparison of weight status among two cohorts of US Air Force recruits, *Prev Med* 2004; 40: 602-09.

12. Janssen, I, Katzmarzyk, P, Ross, R: Waist circumference and not body mass index explains obesity-related health risk. *Am J Clin Nutr 2004;* 79: 379-384.

13. Adams K, Schatzkin A, Harris T, Kipnis V, Mouw T, Ballard-Barbash R, Hollenbeck A. Leitzmann M: Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *New Engl J Med* 2006; 355: 763-78.

14. Hawkins S, Cockburn M, Hamilton A, Mack T: An estimate of physical activity prevalence in a large population-based cohort. *Med Sci Sports Exerc 2004 Retrieved* from http://www.acsc-msse.org on February 7, 2007.

15. Sakuta H, Suzuki T: Physical activity and selected cardiovascular risk factors in middle-aged male personnel of self-defense forces. *Ind Health* 2006; *44:* 184-89.

16. Riley D, Wingard D, Morton D, Nichols J, Ji M, Shaffer R, Macera C: Use of self-assessed fitness and exercise parameters to predict objective fitness. *Med Sci Sports Exerc* 2005; 37: 827-831.

17. DoD TRICARE Management Activity: Population health improvement plan and guide. 2001.

18. Gulliford M, Figueroa-Munoz J, Morgan M: Meaning of access in health care. In M. Gulliford & M. Morgan (Eds), *Access to Health Care*. New York, Routledge, 2003.

19. U.S. Department of Health and Human Services. *Healthy People 2010:* Understanding and Improving Health (2nd ed.) Washington, DC: U.S. Government Printing Office. 2000.

20. Bibb SC. Access and late stage diagnosis of breast cancer in the military health system. *Milit Med* 2000; 165: 585-90.

21. Leininger MM: Culture care diversity and universality: A Theory of nursing, p 47. New York, National League for Nursing Press, 1999.

22. Robbins A, Chao S, Baumgartner N, Runyan C, Oordt M, Fonseca V: A low-intensity intervention to prevent annual weight gain in active duty Air Force members. *Milit Med* 2006; 171: 556-61.

23. Wynd C, Ryan-Wenger N. The health and physical readiness of army reservists: a current review of the literature and significant research questions. *Milit Med* 1998; *163*: 283-87.

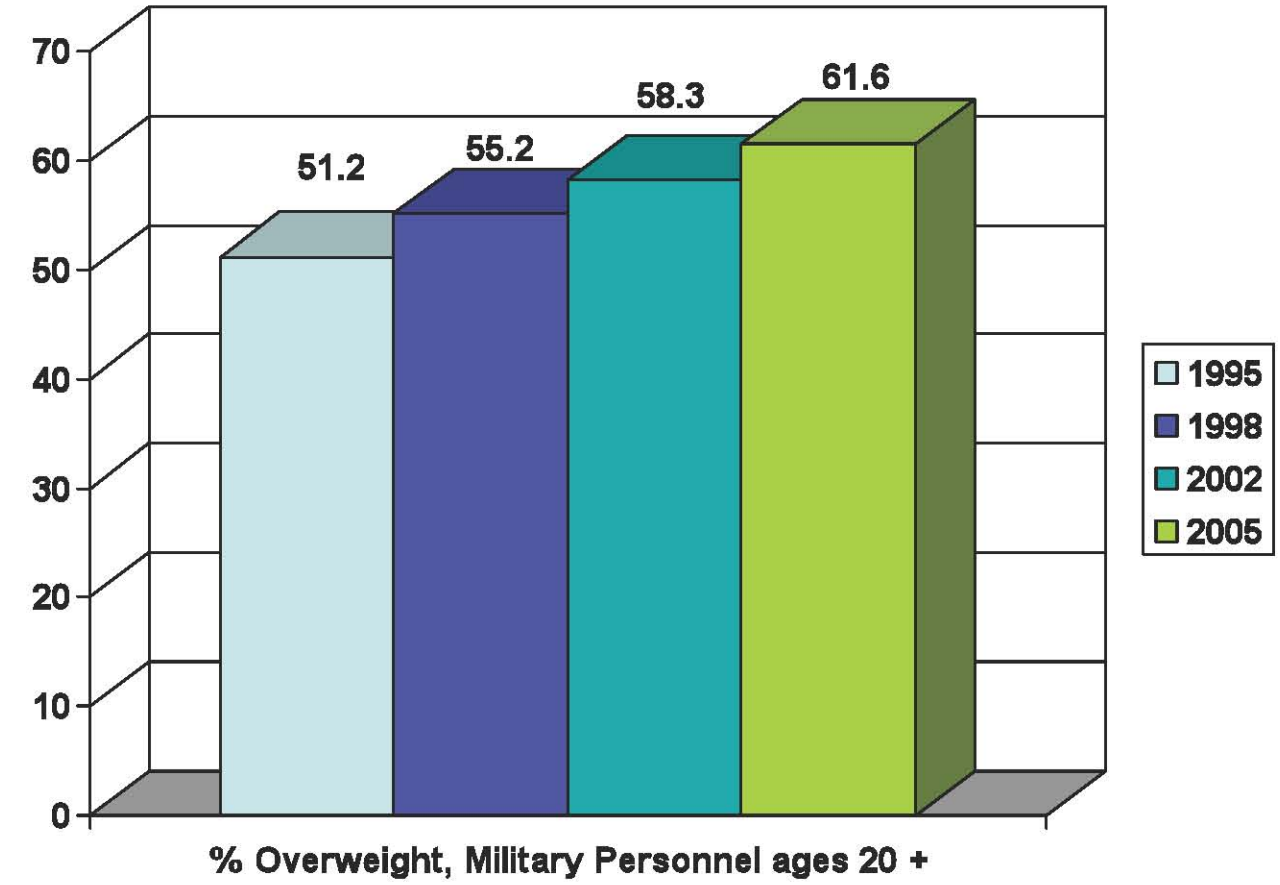
24. Naghii M: The importance of body weight and weight management for military personnel. *Milit Med* 2006; 171: 550-55.

25. Brug J, Lenthe F, Kremers S: Revisiting Kurt Lewin: How to gain insight into environmental correlates of obesogenic behaviors. Am J Prev Med 2006; 6: 525-29.

26. Cornell University, College of Veterinary Medicine. Program on breast cancer and environmental risk factors. 2007; Retrieved on February 9, 2007 from http://environcancer.cornell.edu/obesity/background.cfm

27. Egger G, Swinburn B: An 'ecological' approach to the obesity pandemic. *BMJ 1997; 315*: 477–80.

28. French S, Story M, Jeffery, R: Environmental influences on eating and physical activity. *Annu Rev Public Health 2001*; *22:* 309-35.



Sources: DoD Surveys of Health Related Behaviors Among Active Duty Military Personnel, 1995, 1998, 2002, 2005.[1-4]

From: <milmed@amsus.org>
To: <jbosch@usuhs.mil>
Date: 6/30/2008 6:07 PM
Subject: Manuscript Submission #3

You have successfully submitted your manuscript via the Rapid Review system. Your Manuscript Number is: MM-0230-08 Version 1.

Take note of this number for future reference. You can log on to the Rapid Review system at any time to see the current status of your manuscript(s). The web address is http://www.rapidreview.com/AMSUS/author.html and your username is jbosch.
If you wish to contact the journal office, here's how:

Military Medicine
9320 Old Georgetown Road
Bethesda, MD 20814
Phone: 301-897-8800
Fax: 301-530-5446

Thank you for your submission.
Managing Editor
Military Medicine

Running Head: Body Mass Index and Vigorous Physical Activity

Pages: 28
Words: 3,568
Tables: 7
Figures: 2
References: 15
Contact: Lt Col Julie M. Bosch
Email: jbosch@usuhs.mil
Guarantor: CAPT Sandra Bibb

The Relationship between Body Mass Index and Vigorous Physical Activity in a Military Population

Julie M. Bosch, Lt Col, USAF, NC
Diane Padden, PhD, RN
Sandra C. Bibb, DNSc, RN, (CAPT) ret., USN, NC

Uniformed Services University of the Health Sciences
Graduate School of Nursing
4301 Jones Bridge Road
Bethesda, MD 20814

KEY WORDS

body mass index, vigorous physical activity, fitness, epidemiological triad

Abstract

Background: Despite high rates of vigorous physical activity (PA) the military is far from meeting the *Healthy People 2010* objective that 60% of adults 20 + years will have a healthy weight. **Objective:** Describe the relationship between body mass index (BMI) and vigorous PA among active duty military members. **Design and Methods:** We analyzed existing 2005 Survey of Health Related Behaviors among Military Personnel to obtain an adult sample, 20 to 45 years of age (N=14,852). BMI (weight-kg/height-m2) calculated from self-reported height and weight. A vigorous PA variable was created by transforming three variables (PA occurrence, days per week, and minutes per session) into one variable with three levels. One-way ANOVA and t-tests of independent groups were used to conduct analyses. **Results:** Mean BMI of personnel who met recommendations for vigorous PA was 25.97 (95% CI: 25.8, 26.0), insufficient PA 25.98 (95% CI: 25.90, 26.07) and no vigorous PA 25.95 (95% CI: 25.8, 26.1) was not significantly different (p = .901). There was a significant difference between the BMI of members who passed their recent physical fitness test (M= 25.7, SD=3.38), and those who did not [M=28.9, SD=4.6, t (889.13) =-19.25, p=.000]. The magnitude of the difference was medium (*d* = 1.29, effect size *r* = 0.54). **Implications**: Active duty military personnel at increased risk for disease co-morbidities related to being overweight. Future studies should explore how other unique aspects of the military environment (deployment readiness, stress) affect BMI.

Introduction

The 2005 Department of Defense (DoD) Survey of Health Related Behaviors among Military Personnel (SHRB) results concluded that overweight or *pre-obesity* in military personnel is now *higher* than in the non-active duty population. Consistent with the nationwide trend, overweight based on body mass index (BMI), increased from 50.0% in 1995 to 60.5 % in 2005 for active duty members aged 20 and older. These results parallel a concurrent increase in strenuous exercise consistent with the military's emphasis on physical fitness[1] and suggest that being overweight originates from other factors; in addition to lack of physical activity.[2] The purpose of this article is to describe the relationship between BMI and vigorous physical activity (PA) in military members. The study was conducted using preexisting data from the 2005 SHRB.

Background

The former US Surgeon General of the United States Public Health Service, Dr. Richard H. Carmona, stated the threat of obesity in America is as real as the threat of weapons of mass destruction.[3] Active duty military personnel are at risk for disease co-morbidities related to being overweight. This health risk has a direct effect on military recruits; almost 80% who exceed BMI standards at enlistment, leave the service before completing their first term due in part, to inability to meet BMI standards.[4]

Each of the armed services has unique fitness standards and policies for surveillance testing. In early 2004, the Air Force instituted a health based fitness assessment and screening test to determine if personnel were physically fit.

Currently, Air Force fitness policy mandates an annual measurement of "fitness" (abdominal circumference, timed 1.5 mile-run, and calisthenics). If the service member fails this fit test, their "fatness" is then measured (weight, BMI). Despite this monumental policy change, 77.1% males (35 years and older) in the Air Force are overweight and 21% are obese.[5] New fitness programs, weight requirements, and annual mandatory evaluations may not be sufficient to ensure healthy body weight for Air Force members.

Soldiers in the Army are mandated to maintain physical fitness levels to complete the arduous mission of ground troop support yet their BMI statistics are nearly identical to the Air Force's BMI results (77.1% males 35+ overweight). [1] The Navy's current rate of overweight males (based on BMI), ages 35 and older, is the highest of the four services, 80.1%, and 23.1% are obese. These statistics are at an all-time high for the services, and the numbers have increased every year. Despite the fact the military is a unique culture with policies regarding physical fitness requirements, problems with being overweight persist.

One *Healthy People 2010* objective is that $\geq$ 30% of Americans will engage in vigorous PA at least three times a week.[6] The 2002 DoD SHRB summary reported 70% of military personnel met this objective. [7] In the 2005 SHRB, the definition of "vigorous PA" was redefined; but results were still high at 57.6%, far exceeding *HP 2010* goals. [8] A 2007 scientific statement by the American Heart Association (AHA) defined vigorous PA as an exercise rate of at least 6 metabolic equivalents (METs), which is approximate to jogging. [9] Vigorous PA in the 2005 SHRB is defined as any activity that burns more than 7

kcal/min and achieves 74 to 88 percent of peak heart rate, such as jogging, chopping wood, swimming continuous laps, or bicycling uphill. [5] Despite high rates of self-reported vigorous PA, the military is still not meeting the *HP 2010 Healthy Weight* objective that 60% of adults 20+ years will have a healthy weight (BMI $\geq$18.5 kg/m^2 and < 25.0 kg/m^2). Our long term goal is to understand the relationship between BMI and vigorous PA in an active duty population living in a unique military environment that includes access to health care, mandatory physical fitness standards, and mission readiness to deploy. To date, no study has examined the relationship between BMI and vigorous PA using SHRB data. Therefore, the two *HP* measured objectives (meeting vigorous PA objectives and not meeting healthy weight objective) was explored by analyzing pre-existing data from the 2005 SHRB.

In addition, the relationship between BMI and mandatory physical fitness standards was examined. 'Fitness' and 'fatness' are two very different concepts, both garnering equal attention, but often confused because of the methods used to express fitness data. [4] The focus of this article is vigorous PA and mandatory physical fitness standards and their relationship to BMI.

Conceptual Framework

The traditional epidemiological triad model (host, agent, and environment) has historically been applied to infectious disease epidemics. Epidemics have been optimally controlled when equal attention is paid to all three points of the triad. In 1980, William Haddon applied the triad approach to injury prevention and this led to large-scale reductions in motor vehicle injuries in the ensuring

years. [11] The model has been used to study the obesity epidemic in non-military populations by incorporating both individual and population approaches. In this study, the epidemiological model was used to conceptualize the relationship between BMI and vigorous PA.

In the traditional model the host might refer to fleas that carry infection, the agent could be drinking water, and the environment might refer to a situation that contributes to transmission of infection, such as crowded living conditions. When used to study the obesity epidemic, the host is the target for weight control interventions such as biological factors and behavioral choices of the individual. The agent is viewed as the active cause of the problem, such as energy input and energy expenditure (food and PA). The environment is the physical, economic, and sociocultural factors of the population.

For the purpose of this study, the host was defined as the age, gender, branch of service, race and BMI of the subject, the agent as vigorous PA and the environment as mandatory physical fitness standards. (Figure 1). Using this model moves the research focus from a traditional biomedical paradigm to an epidemiological framework with a much broader view. [11]

Method

Materials

Overview of SHRB primary study.

The Department of Defense (DoD) Surveys of Health Related Behavior among Military Personnel are cross-sectional and designed to represent military service members from all branches stationed worldwide. The survey, initiated in

1980, is conducted every 3 years on military installations and has been used by the DoD to track changes in health behaviors. The 2005 survey continued the focus of earlier surveys and also included *HP 2010* objectives.

The target population for the 2005 SHRB consisted of military personnel with the exception of recruits, service academy students, personnel absent without official leave (AWOL), and personnel who had a permanent change of station (PCS) at the time of data collection. The DoD expanded the scope of the 2005 survey to include national guard and reserve members. Participants completed self-administered questionnaires during April through August 2005. A dual-mode sampling design was used and included group-administration at 395 large installations, which included ships. Surveys were mailed to persons at smaller locations. [5]

After the sample was selected, a sampling weight was calculated for each individual participant. The sum of this weight was approximately 1.2 million, and estimated the approximate number of members with a positive probability of being selected. The overall response rate among those who were eligible to participate was 51.6% which has been consistent since the initial survey. Further explanation of methodological procedures is available from Bray et al. [5]

Procedure

Secondary study

Secondary data analysis (SDA) and a descriptive design were used in this study. SDA is a research process that uses existing data to answer research questions. When used to analyze population health data, SDA is a way to

generate knowledge to improve population health and meet current health care demands. [12]

After securing a data use agreement (DUA) from the Tricare Management Office (TMO), de-identified SHRB data were obtained. The SHRB data did not include coded identifiers; therefore there was no risk of access to information (codes or keys) that could identify survey participants. For this reason, this study was considered IRB-exempt at the Uniformed Services University of the Health Sciences (USUHS) in Bethesda, Maryland.

The data file and accompanying documents were secured and all 600+ variables were methodically reviewed along with the accompanying codebook and questionnaire. Selecting only the variables required for our study, a data subset was created that included respondent identification, stratum, and weighting variables. After applying the inclusion criteria of ages 20 through 45, the final sample consisted of 14,852 subjects. Each variable was coded and labeled to match the original variable descriptions found in the SHRB codebook. Understanding how each variable was originally coded, ensured consistency with our coding system.

Performing initial frequency analyses on all the variables, allowed us to identify missing data and outliers, and foresee trends. A research plan outlined 1) which variables would be used for each statistical test, 2) which statistical tests would best answer specific research questions, 3) were statistical assumptions met for each analysis, 4) if the statistical test met the criteria, and 5) if variables required recoding to meet statistical assumptions. Maintaining a precise and

organized data analysis plan was paramount as there were numerous variables at our disposal.

Sample

Participants were restricted to those between 20 and 45 years of age. Previous SHRB results highlighted that the 'under-20' age group had not been as affected by the overweight epidemic, so they were excluded from the sample. The upper age limit of 45 was established to create the young to middle adult composition we were seeking. Subjects selected for inclusion were from all four services (28.3% Navy, 28.2% Air Force, 22.5% Army, 21.0% Marines), (N = 14,852). The mean age was 30.6 years (as was the median age,) and the mode was 21 years. The sample was 24.7% female and 75.3% male, and diverse in reported ethnic status (62.7% Caucasian, 16.9% African American, 4% Asian, 1% American Indian or Alaska Native, .9% Native Hawaiian, and 14.5% Other).

Study variables

The following variables were included age, gender, race/ethnicity, branch of service, height, weight, calculated body mass index, weight group, vigorous PA, and physical fitness test information. The subjects' BMI (weight-kg/height-m2) was calculated from self-reported height and weight. In the questionnaire, participants were asked for their weight in pounds and their height in feet and inches, therefore, metric conversion values were used from the original data set.

There were numerous questions regarding vigorous PA routines. One question asked participants how many days per week they engaged in vigorous PA. A separate question asked how many minutes they spent in each vigorous

PA session. By transforming three variables (PA occurrence, PA days per week, and PA minutes per session) into one new variable with three levels, there was greater understanding of the participants' specific PA routine.

If the participant reported engaging in vigorous PA, three or more days per week and 20 or more minutes per session, responses were re-coded as 'meets recommendations for vigorous PA'. If the participants reported engaging in vigorous PA, but at less than three times per week or less than 20 minutes per session, responses were re-coded as having 'insufficient activity to meet vigorous PA recommendations'. If the participant reported no vigorous PA, responses coded to the 'no vigorous PA category. These new categories combined multiple components of the subjects' PA routine and matched the *HP 2010* PA objective definition.

Statistical Analysis

Initial analysis of the data included: 1) preliminary examination of all variables, 2) identification of data outliers, and 3) assessment of missing data. Basic analyses computed were measures of central tendency (mean, median, and mode) for scale variables. Descriptive statistics (standard deviations and confidence intervals), one-way analysis of variance (ANOVA), t-tests of independent groups, and chi-square of independence were used. Frequency tables were useful in identifying inaccurate labeling or coding. Statistical Package for the Social Sciences (SPSS) for Windows 14.0 statistical software was used to perform all analyses. A .05 level of probability indicated statistical significance for inferential statistical procedures.

Results

The BMI was a calculated variable, the mean of the sample was 25.98 (SD = 3.62), the median was 25.82 and the mode was 25.85. Figure 2 presents the weight groups based on the Centers for Disease Control (CDC) classification system and the *Dietary Guidelines for Americans 2005*. Most of the subjects in the sample were in the "overweight" category (45.5%, n = 6,758). This category represents a BMI in the 25.0-29.9 range. "Normal" weight group represents a healthy BMI ranging from 18.5 – 24.9, and 35.5% (n = 5,291) of subjects were in this category. The "obese" category indicates a BMI of 30 and higher, and 11.9% (n = 1.761) were in this group. "Underweight" was the smallest category (1.1%, n = 167) depicting a BMI of less than 18.5. Combining the overweight and obese categories, 56% of participants were not at a healthy weight.

The mean BMI of Army personnel in the sample was 25.8 (95% CI: 25.6, 25.9), Navy personnel 26.5 (95% CI: 26.4, 26.66) Marine Corp personnel 25.4 (95% CI: 25.3, 25.6) and Air Force personnel, 25.9 (95% CI: 25.8, 26.0). (Table I). There was a significant difference (p = .000) between the mean BMIs of these four groups. (Table 2).

Greater than one third of the sample (34.1%, n = 5,061) reported engaging in vigorous PA "3 or 4 days a week" (Table 3). Table 4 illustrates how many minutes per session the participants engaged in PA. The results of the transformed vigorous PA variable are that 6,394 subjects reported insufficient PA to meet the minimal vigorous PA definition. (Table 5).

The mean BMI of personnel who met recommendations for vigorous PA was 25.97 (95% CI: 25.8, 26.0), insufficient PA 25.98 (95% CI: 25.90, 26.07) and no vigorous PA 25.95 (95% CI: 25.8, 26.1). There was no significant difference ($p = .901$) between the mean BMIs of these three groups. The mean BMI in all of these PA categories was considered overweight by the National Heart, Lung, and Blood Institute (NHLBI) guidelines[13] (Department of Health and Human Services). (Table 6).

The percent of participants who reported "passing their most recent physical fitness test" was 85.3% (n = 12,669) and those who did not pass 5.9% (n = 871). There was a significant difference between the BMI of members who passed a recent physical fitness test (M= 25.7, SD=3.38), and those who did not [M=28.9, SD=4.6, t (889.13) =-19.25, p=.000]. The magnitude of the difference was in the medium range ($d = 1.29$, effect size $r = 0.54$) (Cohen, 1988).

The transformed vigorous PA variable placed participants into one of three categories: "met PA recommendations" (reported PA occurrence, $\geq$ 3 times weekly, and $\geq$ 20 minutes per session), "insufficient PA to meet vigorous recommendations" (reported PA occurrence, < 3 times weekly, or < 20 minutes per session), and "no vigorous PA" (no reported PA occurrence). Frequency data and 3 X 3 chi square analyses compared these 3 groups of vigorous PA to 3 groups of physical fitness testing outcomes (passed most recent physical fitness test, did not pass most recent physical fitness test, and never had fitness test/was exempt from most recent physical fitness test) were calculated for all categories.

The results of the categories of PA recommendations who passed their most physical fitness test were significantly different from what would be expected due to chance, x^2 (5, N=14,114) = 394.064, p = .000. Standardized residuals (R) were examined to determine which cells contributed the most in creating the significant difference between the observed and expected frequencies. Because cell sizes can differ, the R is important to standardize the difference. An absolute R value > 2.00 is considered a major influence on the significant chi-square test statistic. Participants did not pass their fitness tests and reported no vigorous PA more often than expected (R value = 7.6). Also, proportionately fewer participants than expected (R = 5.7) passed their most fitness test and reported no vigorous PA. See Table 7 for specific results.

Most participants reported not having difficulty meeting their weight and/or body fat standards (76.5%, n = 11,369), but 19.2% did report experiencing difficulty (n = 2,853). There was a significant difference between the BMI of members who did not have difficulty meeting their weight and/or body fat standards (M= 25.1, SD=306), and those who reported difficulty meeting weight standards [M=29.3, SD=3.59, t (3,386.41) =57.768, p=.000]. The magnitude of the difference was also in the medium range (*d* = 1.28, effect size *r* = 0.54)[13].

Discussion

Limitations

SDA and the use of large pre-existing data sets have inherent limitations. Missing data are a concern in most research studies, and in large data sets missing data can be buried in responses such as “don’t know” or “not sure”.

Participants often choose such responses when answering survey questions and accurately coding these responses is paramount. Realizing there might be alternative reasons why the participant did not give an answer; we investigated missing data patterns, and determined what action was appropriate for each question. However, since the SHRB is a well-established survey, missing data were not a significant problem.

A second limitation was the high likelihood of finding statistically significant differences between means without any real clinical significance. Large sample sizes can artificially inflate the significance of results. [13] Our results were often significant at $p < .001$, despite the statistical test used or group means compared. The importance of calculating effect size and Cohen's *d.* [14] cannot be overemphasized and these results were more valuable and relevant since they were independent of sample size.

External validity has the potential to be a threat and potential limitation in SDA. Most large data sets including the SHRB use complex sampling designs and weighted variables, so the results have more generalizability to a population than smaller samples. The original SHRB research team used well-standardized methods of data collection and analysis; therefore external validity threats in our secondary study were minimized.

Bias is a limitation inherent to the SHRB's self-report measurement of body weight, height, and vigorous PA frequencies. However, studies of adults have demonstrated a high correlation between self-reported and measured height and weight. [15]

Implications

Our study was framed by the epidemiological triad model in which the "host" was defined as demographic variables, the "agent" was defined as vigorous PA and the "environment" was mandatory fitness standards. In the traditional use of the model, the host, the agent, and the environment are all related. Using the epidemiological model was useful because the study variables were explored in a similar way. This model illustrates the importance of investigating not only the individual and their health behaviors, but also the environment in which they live. Although military populations exist in a unique culture, they may not be shielded from the overweight trend in the U.S.

Due in part to the results of the 2005 SHRB and the highlight on increased BMI, the DoD and Tricare launched the *Health Choices for Life* initiative, focusing on weight management. Since the 2005 SHRB is the 9th survey in the series, it is clear the BMI in service members continues to rise, consistent with national trends. Future research should perhaps include military members in non-military national surveys that examine health objectives in the U.S. It will be increasingly important to include environmental factors, not simply diet and exercise, in future studies.

Since our analysis showed no statistical significance between the mean BMI and the three vigorous PA groups, it could be argued that vigorous PA alone does not impact BMI. The overweight trend is a complex problem and will need a multi-facet approach to solve.

However, there was a significant difference in BMI means between the group that passed their most recent physical fitness test and those who did not. BMI was significantly lower in those who passed their most recent fitness test. The mandatory physical fitness test may be a powerful contributor in maintaining a healthy BMI.

Conclusions

The relationship between BMI and vigorous PA in a large survey of U.S. military members from four armed services was the focus of this study. Based on the non-significant results between the mean BMIs and vigorous PA groups, it appears the military population is affected by the national overweight trends *despite* their emphasis on vigorous PA. The benefits of vigorous PA are significant and occur even in the absence of weight loss, however, the military has weight standards that a non-military population does not. Therefore, BMI will continue to be an important factor in future research studies.

Based on the significant results between mean BMIs and the two fitness testing groups, mandatory fitness testing standards may have a positive impact on a member's BMI. Exactly what impact these fitness standards have over time, is not known and requires further investigation. Each branch of the military has redefined their fitness policies and standards over the past decade. These policy changes could be explored with BMI trends to determine if fitness policies are effective and beneficial for optimal health. SDA can be useful in this trend analysis, as it can monitor changes over time.

Mandatory physical fitness standards are only one unique component of the military environment that does not exist in a non-military environment. There are other environmental components such as deployment readiness requirements and access to universal health care that could be examined. Do these make a difference in service member's BMI and vigorous PA trends? Future studies should continue to explore unique aspects of the military environment and how they affect BMI.

Acknowledgements

We are grateful to Tricare Management Activity (TMA) for their cooperation and patience while assisting us obtain the 2005 SHRB data and files. Thank you also to Cara Olsen, PhD, biostatistician at the Uniformed Services University, for her support and time as we navigated SPSS and analyzed the data.

References

1. Bray R, Olmsted K, Williams J, Sanchez R, Hartzell: Progress toward *Healthy People 2000* objectives among U.S. military personnel, *Prev Med* 2006; *42:* 390-96.
2. Prentice A, Jebb S: Obesity in Britain: gluttony or sloth? *BMJ 2006;* 311: 437-39.
3. Basu S. Military not immune from obesity 'epidemic'. US Medicine: The voice of federal medicine 2007; Retrieved July 30, 2006, from http://www.usmedicine.com
4. Institute of Medicine of the National Academies. *Weight Management: State of the science and opportunities for military programs.* 2003. National Academies Press: Washington, D.C.
5. Bray R, et al: 2005 Department of Defense Survey of Health Related Behaviors among Military Personnel. 2005. Available at http://www.tricare.osd.mil/main/news/html; accessed October 15, 2007.
6. U.S. Department of Health and Human Services. *Healthy People 2010:* Understanding and Improving Health (2nd ed.) Washington, DC: U.S. Government Printing Office. 2000.
7. Survey of Health Related Behaviors among Military Personnel. (2002). Department of Defense. Executive summary
8. Survey of Health Related Behaviors among Military Personnel. (2005). Department of Defense. Executive summary.
9. Wood S, Lie D: *Risks and benefits of exercise reviewed in AHA statement. Medscape Medical News*, 2007.
10. Poston W, Haddock C, Peterson A, Vander Weg M, Klesges, R, Pinkston M, DeBon, M: Comparison of weight status among two cohorts of US Air Force recruits, *Prev Med* 2004; 40: 602-09
11. Egger G., Swinburn B., Rossner, S: Dusting off the epidemiological triad: could it work with obesity? *Int Assoc of Obes,* 2003; *4*, 115-19.
12. Bibb SC. Issues associated with secondary analysis of population health data. *App Nsg Res* 2000; 20, 94-99.
13. Department of Health and Human Services. Retrieved on May 31, 2008 from http://www.nhlbi.nih.gov/index.htm
14. Magee T, Lee S, Giuliano, K. Munro B: Generating new knowledge from existing data: The use of large data sets for nursing research. *Nsg Res* 2006; 55, S50-56.
15. Cohen J. Statistical power analysis for the behavioral sciences, 2nd ed. 1988; Lawrence Erlbaum, Hillsdale, NJ.
16. Nieto-Garcia F, Bush T. Keyl P: Body mass definitions of obesity: sensitivity and specificity using self-reported weight and height. *Epidemiology* 1990; 1:146-52.

Table 1 Mean BMI by Branch of Service

Branch of Service	N	Mean BMI	SD
Army	3,127	25.80	3.54
Navy	3,931	26.54	3.98
Marine Corp	2,952	25.49	2.97
Air Force	3,967	25.92	3.70
Total	13,977	25.93	3.5

TABLE 2 ANOVA Summary Table for BMI by Branch of Service

Source	df	Sum of Squares	Mean Square	F	Significance
Between Groups	3	2,039.379	679.793	52.20	.000
Within Groups	13,973	181,944.63	13.021		
Total	13,976	183,984.01			

Table 3 Leisure Time Vigorous PA in Past 30 Days

Characteristic	No. of cases	% of total
3 or 4 days a week	5,061	34.1
1 or 2 days a week	3,113	21.0
5 or 6 days a week	2,042	13.7
1 or 3 days per month	1,629	11.0
About every day	1,331	9.0
Never in the past month	1,266	8.5
Total	14,44	97.3

Table 4 Leisure Time Vigorous PA Frequency in Past 30 Days

Characteristic	No. of cases	% of total
30 or more minutes	5,939	40.0
60 or more minutes	3,375	22.7
At least 20 minutes	2.947	19.8
Never in the past month	1,258	8.5
Less than 20 minutes	890	6.0
Total	14,409	97

Table 5 Mean BMI by Vigorous PA Group

Vigorous PA Groups	N	Mean BMI	SD
Met vigorous PA recommendations	4,633	25.97	3.46
Insufficient vigorous PA	6,394	26.98	3.55
No vigorous PA	2,758	25.95	4.00

TABLE 6 ANOVA Summary Table for BMI by Vigorous PA Groups

Source	df	Sum of Squares	Mean Square	F	Significance
Between Groups	2	2.733	1.366	.104	.901
Within Groups	13,782	180455.13	13.094		
Total	13,784	180457.87			

Table 7 Distribution of Vigorous PA Groups, By Fitness Test Results

	Vigorous PA Groups					
	Met Vigorous PA recommendations		Insufficient vigorous PA		No vigorous PA	
Fitness Test Results	n	%	n	%	n	%
Passed fit test	4,292	90.9	5,982	91.2	2.223	78.5
(Std. residual)	1.7		2.3		-5.7	
Did not pass fit test	232	4.9	347	5.3	270	9.5
(Std. residual)	-3.1		-2.4		7.6	
Never had fit test or exempt	199	1.4	230	1.6	339	2.4
(Std. residual)	-3.6		-6.7		14.9	
Total	4,723	97.2	6,559	98.1	2,832	90.4

Note. X^2 (5, N = 14,114) =394.064, p = .000)

Figure 1

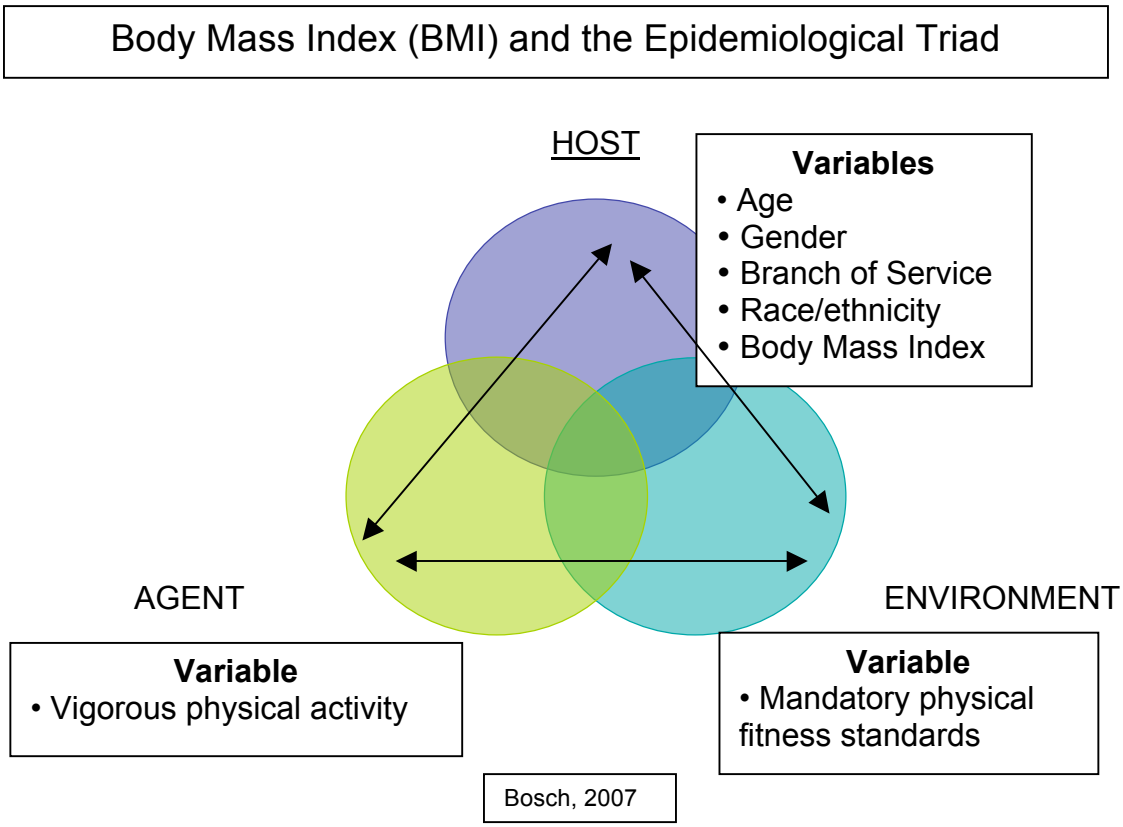
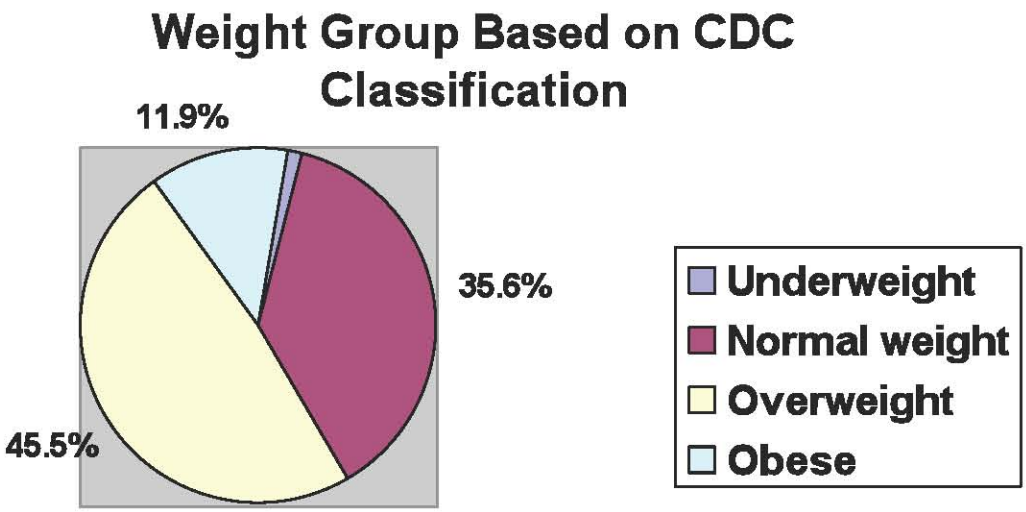

Body Mass Index (BMI) and the Epidemiological Triad
HOST
Variables
• Age
• Gender
• Branch of Service
• Race/ethnicity
• Body Mass Index
AGENT
ENVIRONMENT
Variable
• Vigorous physical activity
Variable
• Mandatory physical fitness standards
Bosch, 2007

Figure 2


Weight Group Based on CDC Classification
11.9%
35.6%
45.5%
Underweight
Normal weight
Overweight
Obese

Uniformed Services University
of the Health Sciences

Manuscript Approval or Clearance*

INITIATOR

USU Principal Author: Julie M. Bosch, Lt Col, USAF, NC

1. Academic Title: Lt Col Julie M. Bosch-PhD candidate in the Graduate School of Nursing, Family Nurse Practitioner,
2. School/Department: USUHS, Graduate School of Nursing
3. Phone: (301)-295-9004
4. Type of Publication (submitted to): Paper Article ✓ Book Chapter
   USU WWW Home Page at (location): None
   Other: None
5. Manuscript title: Access to Health Care, Body Mass Index and Vigorous Physical Activity in a U.S. Adult Population
6. Intended publication (include organization if appropriate): *Applied Nursing Research*
7. Required by (publication receipt) date: 3 July 2008
8. Date submitted for USU approval: 26 June 2008

CHAIR OR DEPARTMENT HEAD APPROVAL

1. Name: Sandra Garmon-Bibb, DNSc, RN
2. School/Department: USUHS, Graduate School of Nursing
3. Date: 6/26/08
4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).
   ***Note:** *It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*
5. ☑ Chair / Department Head Approval

Sandra C. Bibb
Chair / Department Head Approval/Date

(If approval or clearance is required, see other side of form)

PROGRAM DIRECTOR APPROVAL

1. Name: Christine Kasper, PhD, RN, FAAN

2. School/Department: USUHS, Graduate School of Nursing

3. Date: 6-26-08

4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).

*Note: *It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*

5. ☑ Program Director Approval

Program Director Approval/Date

(If approval or clearance is required, see other side of form)

DEAN APPROVAL

1. Name: Ada Sue Hinshaw, PhD, RN, FAAN, Dean and Professor
2. School/Department: USUHS, Graduate School of Nursing
3. Date: _____
4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).
   *Note: *It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*
5. ☑ Dean Approval

Ada Sue Hinshaw 7-3-08

Dean Signature/Date

OUA APPROVAL

1. Name: _____
2. Date: _____

3. ☑ USU Approved or
   ☐ DoD approval/clearance required

4. ☐ Submitted to DoD (Health Affairs) on (date): _____
   or
   ☐ Submitted to DoD (Public Affairs) on (date): _____

5. DoD approved/cleared (as written) or ☐ DoD approved/cleared (with changes)

6. DoD clearance/date: _____

7. DoD disapproval/date: _____

Director, OUA Signature/Date

Submissions Being Processed for Author Julie Bosch, MSN

Page: 1 of 1 (1 total submissions) Display 10 results pe

Action	Manuscript Number	Title	Initial Date Submitted
Action Links		Access to Health Care, Body Mass Index and Vigorous Physical Activity in a U.S. Adult (ages 20-45) Population	Jul 11, 2008

Page: 1 of 1 (1 total submissions) Display 10 results pe

<< Author Main Menu

Uniformed Services University
of the Health Sciences

Manuscript Approval or Clearance*

INITIATOR

USU Principal Author: Julie M. Bosch, Lt Col, USAF, NC

1. Academic Title: Lt Col Julie M. Bosch-PhD candidate in the Graduate School of Nursing. Family Nurse Practitioner.
2. School/Department: USUHS, Graduate School of Nursing
3. Phone: (301)-295-9004
4. Type of Publication (submitted to): Paper Article ✓ Book Chapter
   USU WWW Home Page at (location): None
   Other: None
5. Manuscript title: Environmental Influences on Body Mass Index and Vigorous Physical Activity in Two U.S. Adult Samples
6. Intended publication (include organization if appropriate): *American Journal of Health Promotion*
7. Required by (publication receipt) date: 20 July 2008
8. Date submitted for USU approval: 10 July 2008

CHAIR OR DEPARTMENT HEAD APPROVAL

1. Name: Sandra Garmon-Bibb, DNSc, RN
2. School/Department: USUHS, Graduate School of Nursing
3. Date: 7/10/08
4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).
   ***Note:** It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*
5. ☑ Chair / Department Head Approval (Dissertation proposal / Research Chair)

Sandra C. Bibb
Chair / Department Head Approval/Date

(If approval or clearance is required, see other side of form)

PROGRAM DIRECTOR APPROVAL

1. Name: Christine Kasper, PhD, RN, FAAN
2. School/Department: USUHS, Graduate School of Nursing
3. Date: _____
4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).
   *__Note:__ *It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*
5. ☑ Program Director Approval

_____
Program Director Approval/Date

(If approval or clearance is required, see other side of form)

DEAN APPROVAL

1. Name: Ada Sue Hinshaw, PhD, RN, FAAN, Dean and Professor
2. School/Department: USUHS, Graduate School of Nursing
3. Date: _____
4. ☐ Higher approval/clearance required (for University-, DoD or U.S. Governmental-level policy, communication systems or weapons issues review*).
   *__Note:__ *It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the approving authority.*
5. ☑ Dean Approval

Ada Sue Hinshaw 7-16-08
Dean Signature/Date

OUA APPROVAL

1. Name: _____

2. Date: 7/17/08

3. ☑ USU Approved or
   ☐ DoD approval/clearance required

4. ☐ Submitted to DoD (Health Affairs) on (date): _____
   or
   ☐ Submitted to DoD (Public Affairs) on (date): _____

5. DoD approved/cleared (as written) or ☐ DoD approved/cleared (with changes)

6. DoD clearance/date: _____

7. DoD disapproval/date: _____

_____
Director, OUA Signature/Date

From: <dmosher@allenpress.com>
To: <jbosch@usuhs.mil>
Date: 7/2/2008 4:54:45 PM
Subject: Abstract Approved-Manuscript may be submitted to American Journal of Health Promotion

Congratulations. Your abstract has been approved for submission. The Editor has determined the article best fits the following article type and topic area:

Format: Quantitative Research
Topic: Fitness

Your manuscript has been assigned #080702-QUAN-112. You should refer to this number on all future correspondence.

Please submit the manuscript so that we may start the external review process. You may upload the manuscript and supplemental files by following the link below:

<http://ajhp.allentrack.net/cgi-bin/main.plex?el=A4BH2yq6A3BUi1J4A9TBB0lJ9on28jQgNYlhQYXAZ>

Clicking on the above should take you to your homepage on the AllenTrack peer review system where you will find the following links:

1) Author Instructions, which includes information about the review process, as well as formatting guidelines for the article type shown above. The second part of these instructions also includes information about submitting your manuscript files.
2) A link to your manuscript file so that you can complete your submission.

(This page is also where you will be able to keep track of the progress of your manuscript as it travels through review.)

Once we receive your completed submission, we can start the external review process. Please note that an automated system deadline for submission has been set for one year (July 02, 2009); however, if it turns out that you need a longer period of time, please contact me at the email address given below.

If you have any questions, please let me know.

Best regards,

Debby Mosher
Managing Editor, American Journal of Health Promotion
dmosher@allenpress.com
(800) 627-0326 x132

CC: <ufsbosch@aol.com>

AMERICAN JOURNAL of
Health Promotion

Detailed Status Information

Manuscript #	080702-QUAN-112
Current Revision #	0
Submission Date	2008-07-02 15:53:21
Current Stage	Initial QC
Title	Environmental Influences on Body Mass Index and Vigorous Physical Activity in Two U.S. Adult (ages 20-45) Samples
Manuscript Type	Quantitative Research
Approved Manuscript Due Date	2009-07-02
Corresponding Author	Ms. Julie Bosch (USUHS)
Contributing Authors	Dr. Diane Padden , Dr. Sandra Bibb
Abstract	Purpose: Investigate how environmental factors influence the relationship between body mass index (BMI) and vigorous physical activity (PA) in a military and a non-military adult sample. Design: Descriptive, comparative. Subjects: Adults (ages 20-45) from two nationally recognized large surveys. Methods: Secondary data analysis was used to analyze existing 2005 Behavioral Risk Factor Surveillance System and 2005 Survey of Health Related Behaviors among Military Personnel data. Measures: Descriptive statistics, one-way ANOVA and t-tests. Analysis: BMI (weight-kg/height-m2) calculated from reported height and weight. Healthy People 2010 leading health indicators were measured. Results: The mean BMI of non-military adults who met recommendations for vigorous PA, 26.01 (95% CI: 25.96, 26.06), insufficient vigorous PA 26.80 (95% CI: 26.74, 26.87), or no vigorous PA 27.85 (95% CI: 27.79, 27.90) was significantly different (p = .000). The mean BMI of military personnel who met recommendations for vigorous PA; 25.97 (95% CI: 25.8, 26.0), insufficient vigorous PA; 25.98 (95% CI: 25.90, 26.07), or no vigorous PA; 25.95 (95% CI: 25.8, 26.1) was not significantly different (p = .901). Conclusions: Using an epidemiological triad model illustrated the importance of exploring the individual, their health behaviors and their environment. Despite vigorous physical activity, the military and non-military populations are not meeting the Healthy People 2010 objective, that "60% of adults 20+ years will have a healthy weight.
Keywords	mass index, igorous physical activity, military, BRFSS, SHRBAMP, secondary data analysis
Conflict of Interest	**No,** there is no conflict of interest that I should disclose, having read the above statement.
Copyright Release Date	Not Received

Stage	Start Date
Initial QC	2008-07-17 12:18:27
Manuscript Submission	2008-07-17 11:55:33

2008 KAREN A. RIEDER RESEARCH/ FEDERAL NURSING POSTER SESSION

JOINT CALL FOR ABSTRACTS

Joint sponsors of the Karen A. Rieder Research /Federal Nursing Poster Session are the **TriService Nursing Research Program (TSNRP)** and the **Federal Nursing Service**. Initiated by the **Navy Nurse Corps** in honor of its first Navy nurse researcher, the **Karen A. Rieder** poster session was sponsored by the Navy Nurse Corps for 17 years. Over time, the poster session evolved to include all three military NC services and was later combined with the federal nursing poster session at AMSUS. Registered nurses in the U.S. Army, Navy, Air Force, National Guard, Public Health Service, Department of Veterans Affairs, and the American Red Cross are invited to submit abstracts. Karen Rieder Research posters are dedicated to sharing professional nursing research findings. The Federal Nursing Section focuses on sharing professional nursing knowledge and improving the delivery of health care services. The 2008 Karen A. Rieder Nursing Research/Federal Nursing Poster Session will be held on **Monday, 10 November 2008** in conjunction with the 114th Annual Meeting of AMSUS in **San Antonio, Texas, 9-14 November 2008.**

Requirements for Research Posters

* The principal investigator must be a registered nurse in the federal service or the American Red Cross.
* The research must have been initiated/completed within the past 5 years.
* Studies involving human subjects or animals may be required to have an IRB or IACUC approval #.
*Funding sources should be noted on the abstract and poster.
* Abstracts must address the following:
    - Aims/Objectives of the study, including hypothesis or research question.
    - Theoretical framework.
    - Research design, methods, and statistical analysis
    - Study findings and implications for nursing.
*Abstracts will be reviewed by a panel of Nurse Scientists.

Suggested Topics for Federal Nursing Service Posters

Joint Medical Training	Health Promotion	Rehabilitation/Combat Casualties
Innovative Clinical Practice Issues	Medical Readiness	Treatment of PTSD
Joint Operational Exercises	Pre-Deployment Issues	Family/Community/reintegration
Joint Service Initiatives	Post Deployment Issues	Multidisciplinary Approach to Care

Selection of Abstracts for Presentation

* The selection committee will consider diversity of topics and exhibition space in making selections.
* Awards will be presented to top scorers.
* Each presenter selected may present only one poster.

* To submit an abstract, visit <**www.usuhs.mil/tsnrp** or **www.hjf.org/Events**> after 1 April 2008.
* Submission deadline: **30 June 2008.**

For questions about the 2008 poster session please contact:
TriService Nursing Research Program
POC Maria R. Burcroff
mburcroff@usuhs.mil

2008 Karen A. Rieder Research/Federal Nursing Poster Session

Thank you for your poster submission.

For those of you who do have something to diclose, Maria Burcroff will send you the CE Disclosure Form with instructions.

For any questions or concerns, please contact:
Maria Burcroff
Fax: 301-295-7052
Email: mburcroff@usuhs.mil

You will be notified by August 15, 2008 of the status of your submission.

The Relationship Between Body Mass Index and Vigorous Physical Activity in an Active Duty Military Population

Lt Col Julie Bosch, USAF, NC
PhD, CRNP
Sandra Bibb, USUHS
DNSc, RN
Diane Padden, USUHS
PhD, RN

Objectives:
1. Understand that the military population is affected by the national overweight trends despite the emphasis on vigorous PA. 2. Describe how the epidemiological triad model conceptualized the variables in this study. 3. Describe the relationship between body mass index (BMI) and vigorous PA among active duty military members in the study sample.

ABSTRACT:
Background: Despite high rates of vigorous physical activity (PA), the military is far from meeting the Healthy People 2010 objective that 60% of adults 20+ years will have a healthy weight. Objective: Describe the relationship between body mass index (BMI) and vigorous PA among active duty military members. Theoretical Framework: The epidemiological triad model conceptualized individuals, their health behaviors, and the military environment. Design and Methods: We analyzed existing 2005 Survey of Health Related Behaviors Among Military Personnel to obtain an adult sample, 20 to 45 years of age (N = 14,852). BMI (weight-kg/height-m^2) was calculated from self-reported height and weight. A vigorous PA variable was created by transforming three variables (PA occurrence, days per week, and minutes per session) into one variable with three levels. One-way ANOVA and t-tests of independent groups were used to conduct analyses. Results: The mean BMIs of personnel who met recommendations for vigorous PA, 25.97 (95% CI: 25.8, 26.0); insufficient PA, 25.98 (95% CI: 25.90, 26.07); or no vigorous PA, 25.95 (95% CI: 25.8, 26.1) were not significantly different (p = .901). There was a significant difference between the BMI of members who passed their recent physical fitness test (M = 25.7, SD = 3.38), and the BMI of those who did not (M = 28.9, SD = 4.6, t [889.13] = −9.25, p = .000]. The magnitude of the difference was medium (d = 1.29, effect size r = 0.54). Implications: The military population exists in a unique culture; however, it is not being shielded from the overweight trend in the U.S. despite the emphasis on vigorous PA.

THE RELATIONSHIP BETWEEN BODY MASS INDEX AND VIGOROUS PHYSICAL ACTIVITY IN AN ACTIVE DUTY MILITARY POPULATION

Julie M. Bosch, Lt Col, USAF, NC; Diane L. Padden, PhD, CRNP; & Sandra C. Bibb, DNSc., CAPT, USN (ret)
Graduate School of Nursing, Uniformed Services University of the Health Sciences

BACKGROUND & PROBLEM

- Physical fitness of service members is an important attribute that directly influences the effectiveness of the military organization and the outcomes of the mission.
- Each branch of the armed forces has unique standards for physical fitness and weight standards, as well as programs and policies to ensure compliance with these standards.
- Despite high rates of vigorous physical activity (PA), the military is far from meeting the *Healthy People 2010* objective that "60% of adults 20 years and older will have a healthy weight".

OBJECTIVES

- Investigate the relationship between body mass index (BMI) and vigorous physical activity (PA) among military members.
- Describe the relationship between BMI and mandatory physical fitness standards.

THEORETICAL FRAMEWORK

- Epidemiological Triad Model, originally used to address infectious disease epidemics, but noncommunicable diseases have also benefited from this innovative approach.
- Offers a unique view, not solely from an individual perspective, but an epidemiological standpoint better suited to develop future population health intervention programs.

Research sponsored by the Graduate School of Nursing, Uniformed Services University. The views expressed in this poster are those of the researchers and do not necessarily reflect those of the Uniformed Services University, the Department of Defense, or the US Government.

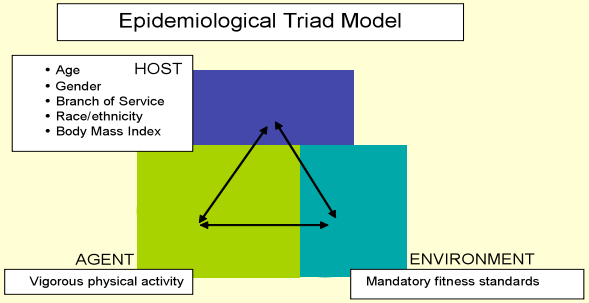


TABLE 1 Mean BMI by Vigorous PA Group

Vigorous PA Groups	N	Mean BMI	SD
Met vigorous PA recommendations	4,633	25.97	3.46
Insufficient vigorous PA	6,394	25.98	3.55
No vigorous PA	2,758	25.95	4.00

TABLE 2 ANOVA Summary Table for BMI by Vigorous PA Group

Source	df	Sum of Squares	Mean Square	F	Significance
Between Groups	2	2.733	1.366	.104	**.901**
Within Groups	13,782	180455.13	13.094		
Total	13,784	180457.87			

RESULTS

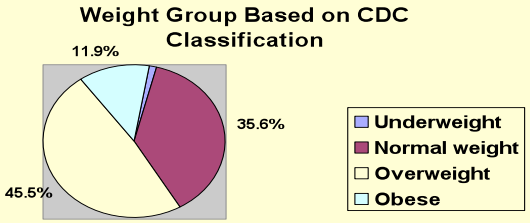
There was a significant difference between the mean BMI of members who passed a recent physical fitness test (M= 25.7, SD = 3.38), and those who did not [M = 28.9, SD = 4.6, t (889.13) = -19.25, p =.000]. The magnitude of the difference was medium (*d* = 1.29, effect size *r* = 0.54).

RESEARCH DESIGN AND METHODS

- Descriptive design
- Secondary Data Analysis using well-established DoD dataset
- Survey of Health Related Behaviors among Military Personnel (2005)

STATISTICAL ANALYSIS

- BMI (weight-kg/height-m2) calculated from self-reported height and weight.
- A new vigorous PA variable was created by transforming three variables (PA occurrence, PA days per week, and PA minutes per session) into one variable with three levels.
- Sample of adults 20 to 45 years of age (N = 14, 852)



IMPLICATIONS FOR NURSING

- Active duty military personnel at increased risk for disease co-morbidities related to being overweight.
- Future studies should explore how vigorous PA and mandatory physical fitness standards affect BMI.

Dissertation Defense

Julie M. Bosch, Lt Col, USAF, NC
Uniformed Services University
July 21, 2008

Epidemiological Factors Associated with Increased Body Mass Index in Active Duty Military Engaged in Vigorous Physical Activity

Key players

- Dissertation Committee
  - Chair
    - Sandra Bibb, DNSc, RN, (CAPT) ret., USN, NC
  - Members
    - Diane Padden, PhD, RN
    - Tracy Sbrocco, PhD
- Acknowledgements
  - Cara Olsen, PhD
  - Diane Seibert, PhD, CRNP
  - Tricare Management Activity (TMA)

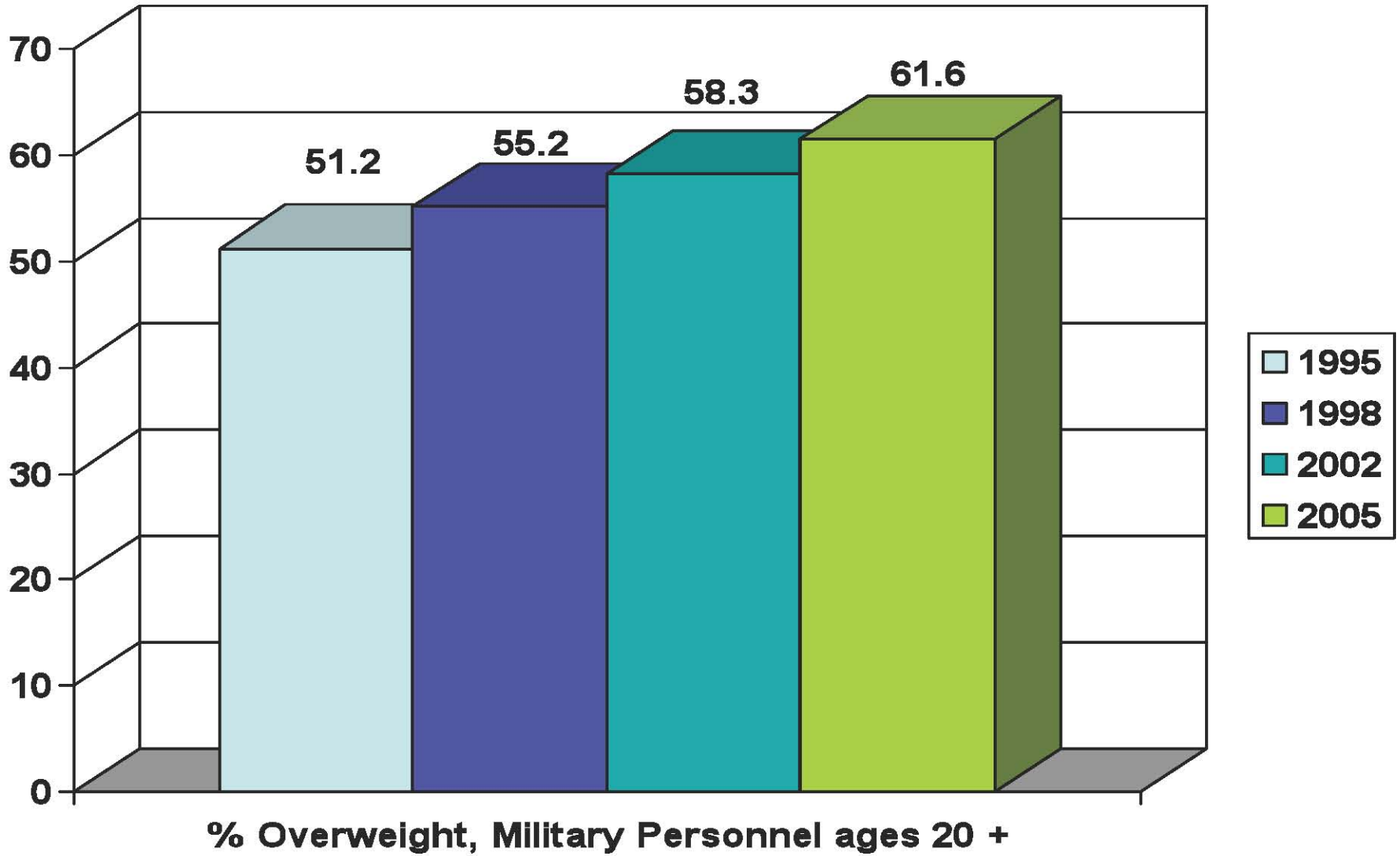
Background & Significance

- **World Health Organization** recently described “globesity” as a global epidemic affecting 300 million people worldwide (WHO, 2004).
- **U.S.** has highest prevalence of obesity in the world
- Major burden of obesity related illnesses (hypertension, hyperlidemia, diabetes)

Background & Significance

- Overweight or *pre-obesity* in military personnel is now *higher* than in the non-active duty population (Bray, 2005)

- Service members may not be protected from overweight & obesity trend
  - Emerge from family culture
  - Live in American culture
  - Work in unique military culture



Sources: DoD Surveys of Health Related Behaviors Among Active Duty Military Personnel, 1995, 1998, 2002, 2005.[1-4]

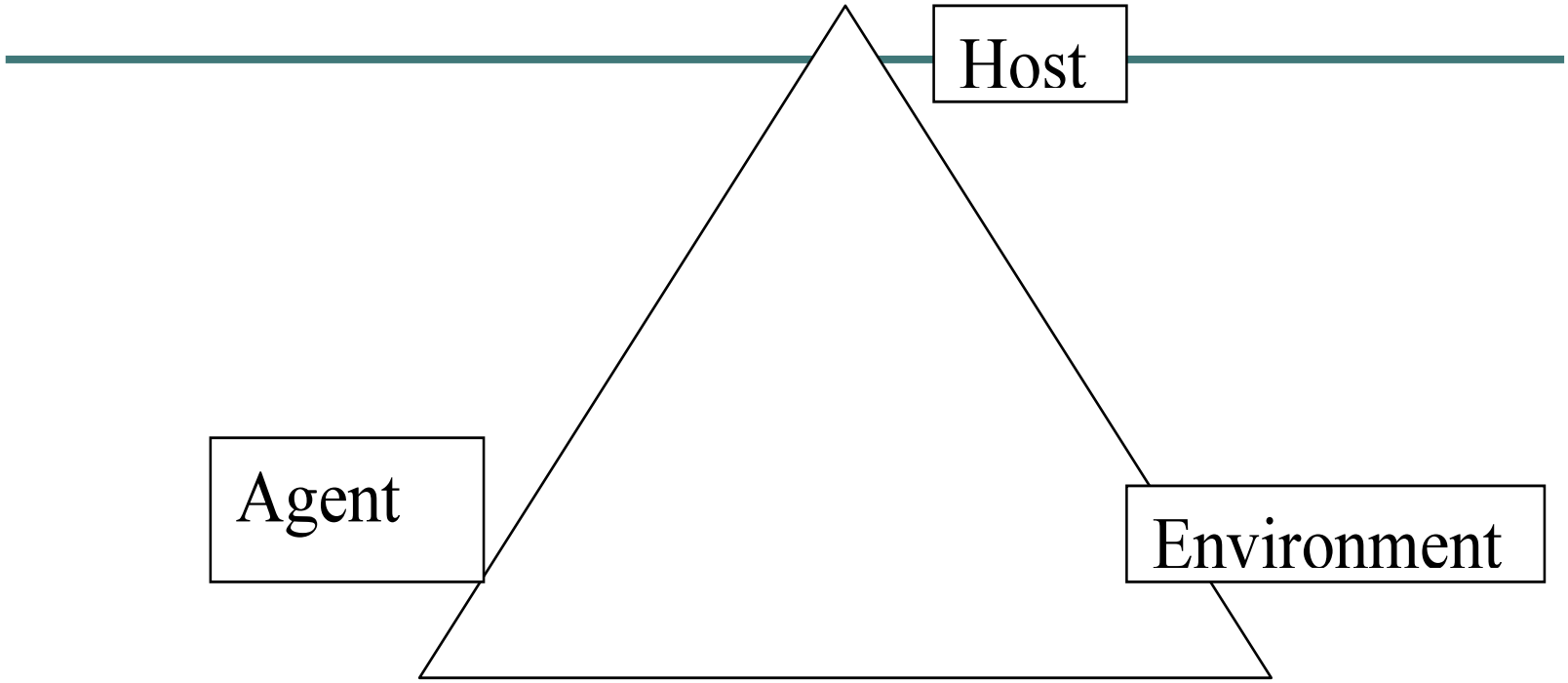
Federal Relevance

- Decreased pool of eligible recruits
- Increased cost of military health care related to co-morbid diseases
- Operational readiness threatened
- High operations tempo with increased deployment of reserve troops

Specific Aims

- #1: To describe the relationship between epidemiological factors and increased BMI in active duty military and non-active duty who report engaging in vigorous activity.
- #2: To compare the relationship between epidemiological factors and increased BMI in active duty military and non-active duty who report engaging in vigorous activity.
- #3: To determine the appropriateness of using an epidemiological triad model to frame the comparison.

Epidemiological Triad



In its classic use, epidemiology considers the interaction of three factors in the development of disease: the *host*, the *agent*, and the *environment*, which is called the Epidemiological Triad.

Methods - Design

- Design
  - Descriptive/comparative
- Secondary Data Analysis (SDA)
  - Research process that uses existing data to answer research questions
  - When used to analyze population health data, SDA is a way to generate knowledge to improve population health and meet current health demands (Bibb, 2007).

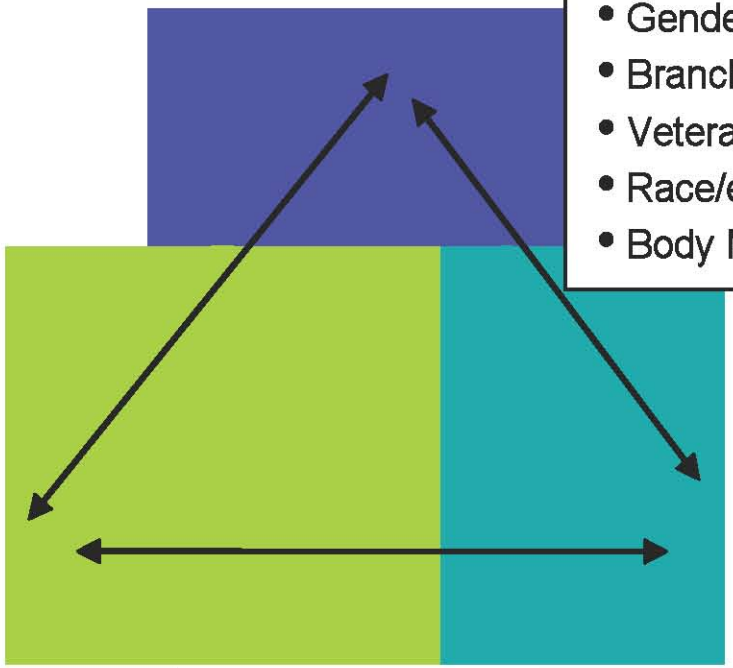
Methods - Primary data set

- 2005 Survey of Health Related Behavior among Military Personnel (SHRB)
  - Sponsored by the Office of the Assistant Secretary of Defense
  - 9th in a series since 1980
  - Cross-sectional survey
  - Comprehensive sampling plan
  - Represents military service members from all branches worldwide (stratified for each service)
  - Anonymous, self-administered questionnaire
  - Tracks *Healthy People 2000 & 2010* objectives

Methods - Primary data set

- 2005 Behavioral Risk Factor Surveillance System
  - Established in 1984 by the Center for Disease Control
  - Largest continuously conducted telephone survey in the world
  - Multi-stage cluster design
  - Random dialing method of sampling
  - Civilian residents age 18 years and older
  - Conducted by all 50 states and U.S. territories health departments
  - Tracks *Healthy People 2000 & 2010* objectives

Body Mass Index (BMI) and an Epidemiological Triad Model



Variables

- Age
- Gender
- Branch of Service (SHRB)
- Veteran Status (BRFSS)
- Race/ethnicity
- Body Mass Index

Variables

- Vigorous physical activity
- Fast food intake
- Fruit and vegetable intake

Variables

- Access to health care (BRFSS)
- Deployment readiness (SHRB)
- Mandatory physical fitness standards

Bosch, 2007

Secondary sample data sets

- Institutional Review Board - exempt
- Data Use Agreement (SHRB)
- Obtaining de-identified data
  - Inclusion criteria (ages 20-45)
  - Cleaned & scrubbed data
  - Code & label appropriate variables
  - Outline research plan

Data Analysis

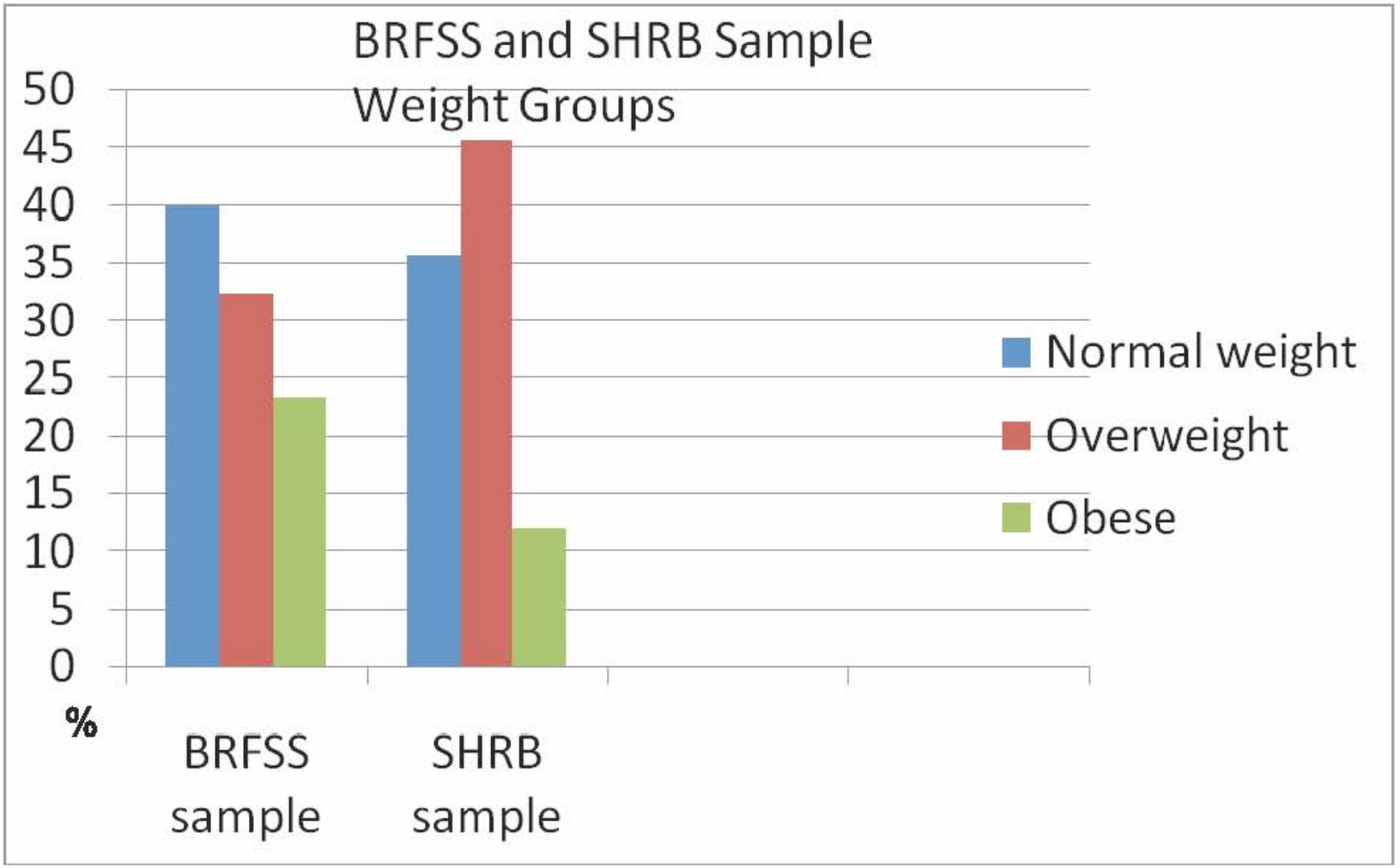
- Descriptive statistics
  - Means, medians, standard deviations (SD)
- T-tests
  - Independent samples
- Analysis of Variance (ANOVA)
  - Frequencies, means, & SD for continuous variables
- Nominal categories
  - Chi-square test of independence
- All data were statistically analyzed at an alpha of .05 with 95% confidence intervals.

Specific Aim #1

- To describe the relationship between epidemiological factors and increased BMI in active duty military (2005 SHRB) and non-active duty (2005 BRFSS) who report engaging in vigorous activity.

Results - Demographics

Variable	2005 BRFSS (N = 131,377)	2005 SHRB (N = 14,852)
Age, mean ± SD (years)	34.67 ± 7.03	30.6 ± 7.6
Gender, male/female, *n* (%)	50,692 (38)	11,190 (75.3)
	80,685 (61.4)	3,662 (24.7)
Racial ethnicity, *n* (%)		
Caucasian	4,252 (58.9)	9,312 (62.7)
African American	468 (6.5)	2,510 (16.9)
Asian	1,176 (16.3)	596 (4.0)
Hawaiian/Pacific Islander	437 (6.1)	129 (.9)
Alaskan/American Indian	353 (4.9)	152 (1.0)



Based on Center for Disease Control (CDC) BMI Guidelines:

Normal weight, <25.0 kg/m2; overweight, >25.0 kg/m2; obese > 300 kg/m2;

Mean BMI by Deployment Frequency Groups	
Deployment Frequency Groups	2005 SHRB sample
Not deployed in past 3 years	
N	5,588
Mean BMI	**25.69** kg/m^2
SD	3.68
Deployed once in past 3 years	
N	4,223
Mean BMI	**25.93** kg/m^2
SD	3.60
Deployed twice in past 3 years	
N	2,223
Mean BMI	**26.32** kg/m^2
SD	3.46
Deployed three times in past 3 years	
N	1,772
Mean BMI	**26.48** kg/m^2
SD	3.52

ANOVA Summary SHRB BMI and Deployment Frequency Groups					
Source	df	Sum of Squares	Mean Square	F	Significance
Between Groups	3	1186.617	395.539	30.408	.000
Within Groups	13,802	179530	13.008		
Total	13,805	180716			

Results (SHRB sample)

- BMI
  - Personnel who passed a recent physical fitness test
    - Mean = 25.7
      - SD = 3.38
  - Personnel who did not pass a recent physical fitness test
    - Mean = 28.9
      - SD = 4.6
  - -t-test (889.13) = - 19.25, $p < .001$
  - d = 1.29, effect size r = 0.54 (medium)

Results (BRFSS sample)

- BMI
  - Adults who had health care coverage
    - Mean = 26.96
      - SD = 5.93
  - Adults who did not have health care coverage
    - Mean = 27.21
      - SD = 6.25
  - -t-test (31,781) = -5.42, $p < .001$
  - *d* = 0.03, effect size r = 0.01 (small)

Specific Aim #2

- To compare the relationship between epidemiological factors and increased BMI in active duty military (2005 SHRB) and non-active duty (2005 BRFSS) who report engaging in vigorous activity.

Healthy People 2010 and sample results (2005 BRFSS & SHRB data)			
HP 2010 Leading Health Indicator	HP 2010 objective	Current Study Results (2005 BRFSS)	Current Study Results (2005 SHRB)
Overweight or Obese	60% US adults (20 or older) at healthy weight (BMI 18.5 - 25.0 kg/m^2	38.0% at healthy weight	35.6% at healthy weight

Healthy People 2010 and sample results (2005 BRFSS & SHRB data)			
HP 2010 Leading Health Indicator	HP 2010 objective	Current Study Results (2005 BRFSS)	Current Study Results (2005 SHRB)
Access to Health Care	1) Increase the proportion of persons with health insurance: Goal 100% 2) Increase the proportion of persons with a usual primary care provider: Goal 85%	1) 81% of sample had health care coverage 2) 68.8% of sample had one primary care provider	1) 100% of sample had health care coverage

Healthy People 2010 and sample results (2005 BRFSS & SHRB data)			
HP 2010 Leading Health Indicator	HP 2010 objective	Current Study Results (2005 BRFSS)	Current Study Results (2005 SHRB)
Physical Activity (PA)	30% US adults engage vigorous PA 3 or more days per week and 20 or more minutes per session	30 % met vigorous PA recommandations	45.3% met vigorous PA recommandations

ANOVA Summaries BMI and Vigorous PA Groups

Source (BRFSS)	**df**	**Sum of Squares**	**Mean Square**	**F**	**Significance**
Between Groups	2	76,570.25	38,285.12	1,080.62	.000
Within Groups	120,071	4,253,943	35.429		
Total	120,073	4,330,513			
Source (SHRB)	**df**	**Sum of Squares**	**Mean Square**	**F**	**Significance**
Between Groups	2	2.733	1.366	.104	.901
Within Groups	13,782	180455.13	13.094		
Total	13,784	180457.87			

Specific Aim #3

- To determine the appropriateness of using an epidemiological triad model to frame the comparison.
  - Research focus away from traditional biomedical paradigm to a broader view that includes a environmental influences
  - Limited framework to compare military to non-military environments because of the differences.

Limitations

- Missing data
  - Well-established surveys, minimal problem
- Statistical significance
  - High likelihood based on sample size alone
- External validity
  - Size & demographic differences of sample groups
- Bias
  - Self-reported measurement of BMI & PA
- BMI
  - Does not take into account muscle mass or total body fat percentage

Implications

- Military population affected by national overweight trends *despite* emphasis on vigorous PA
  - Benefits of PA occur in absence of weight loss
    - Reality: Weight standards exist in military culture
- Military members not protected from U.S. environmental influences that affect BMI
- Overweight military members may impact operational readiness

Future Research

- Include military members in non-military national surveys that examine health objectives in the U.S.
- Epidemiological factors related to BMI
  - Reservists and readiness related to BMI
  - Specific services & deployment requirements
  - Access to health care affect BMI
  - Unique occupational stressors
  - Family separations
  - Changing fitness policies
  - “Built environment”

Conclusions

- Obesogenic environment demands that U.S. adults strive for energy balance in an unbalanced world
- American cultural norms influence military members, as compared to *intended* influence of military cultural values, beliefs, and practices.
- U.S. environmental factors may *adversely* affect dietary habits, PA levels, & health behavior choices

THANK YOU FOR YOUR ATTENTION.

QUESTIONS?

The Relationship between Body Mass Index and Vigorous Physical Activity in a Military Population

Julie M. Bosch, Lt Col, USAF, NC
Uniformed Services University
May 12, 2008

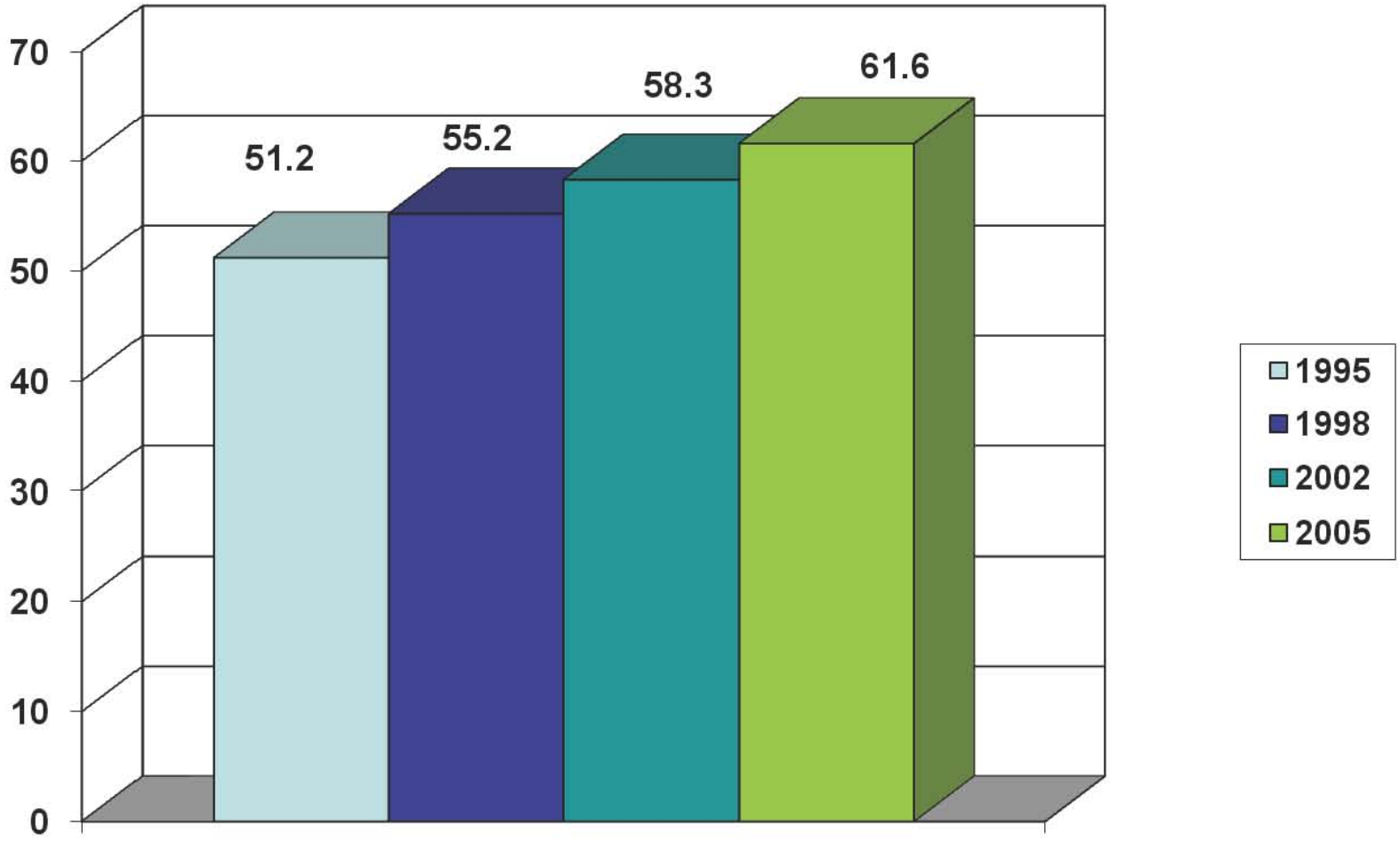
Key players

- Dissertation Committee
  - Chair
    - Sandra Bibb, DNSc, RN, (CAPT) ret., USN, NC
  - Members
    - Diane Padden, PhD, RN
    - Tracy Sbrocco, PhD
- Acknowledgements
  - Cara Olsen, PhD
  - Tricare Management Office (TMO)

Background

- *Healthy People 2010* objective
  - Increase the proportion of adults who engage in vigorous physical activity (PA) 3 or more days/week, for 20 or more minutes per session
  - Target: ≥ 30% of adults
  - Military: 57.6%
  - Goal: met
- *Healthy People 2010* objective
  - Adults 20+ years will have a healthy weight
  - Target: 60%
  - Military: 37.2%
  - Goal: not met

Sources: DoD SHRB, 1995, 1998, 2002, 2005



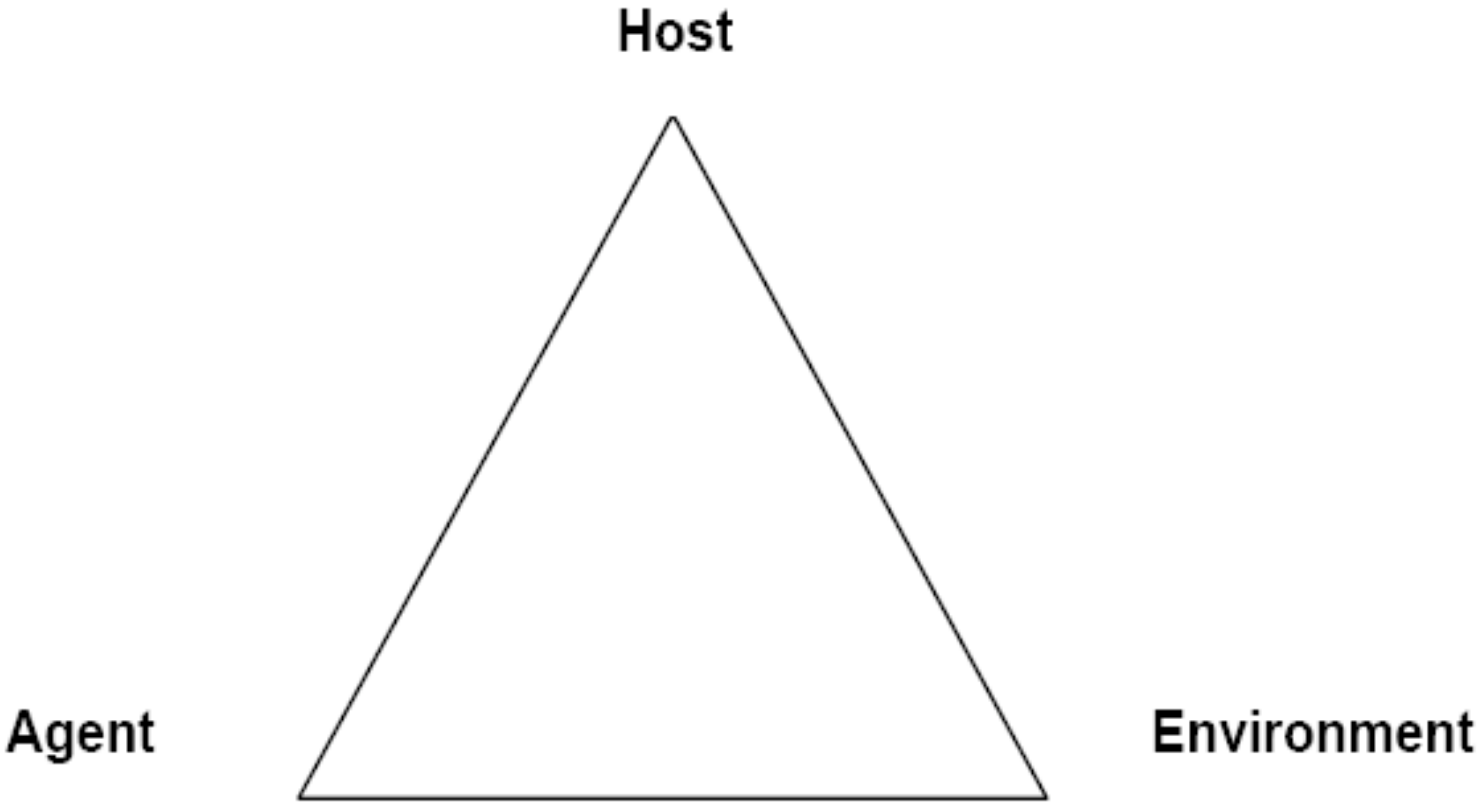
Purpose

- To describe the relationship between body mass index (BMI) and vigorous physical activity (PA) among active duty military members using preexisting data from the 2005 Survey of Health Related Behaviors among Military Personnel (SHRB)

Conceptual Framework

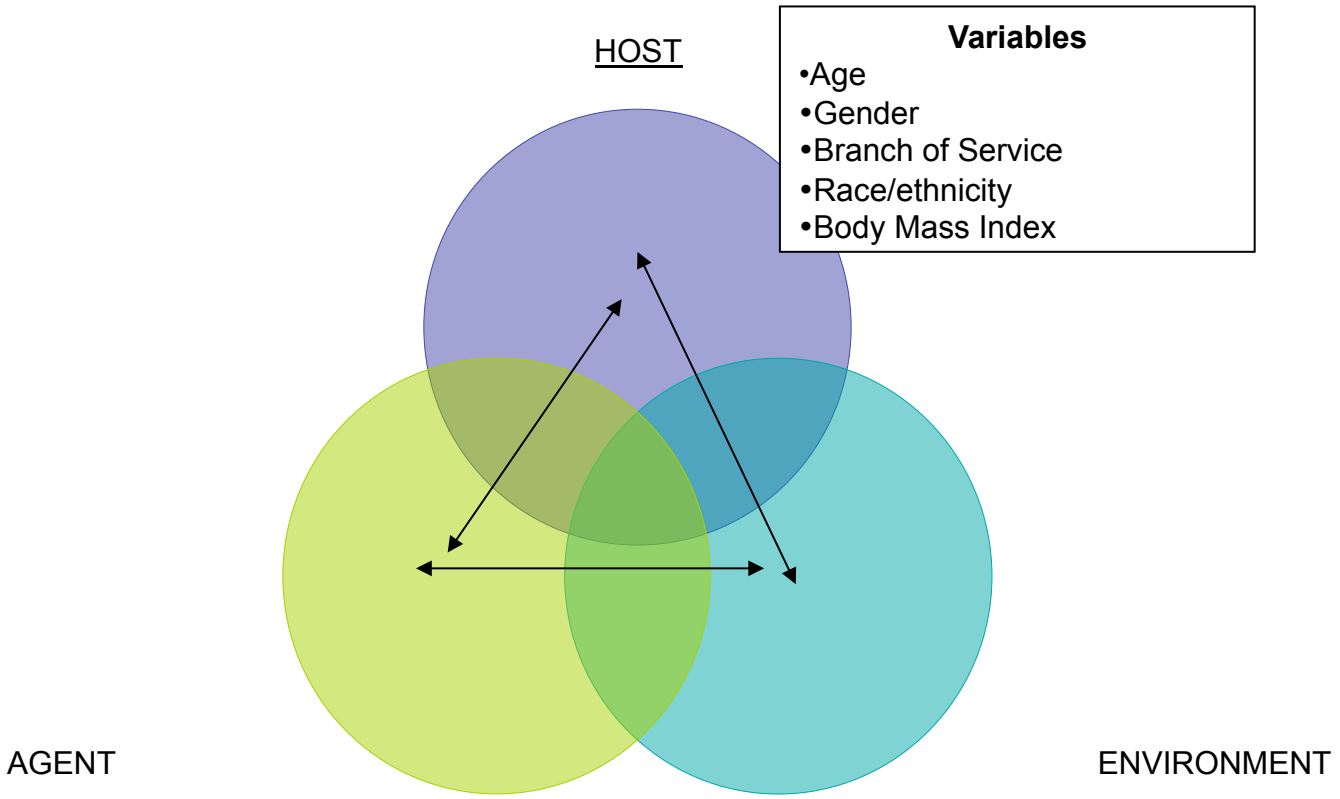
- Epidemiology Triad Model
  - Host (mosquito)
  - Agent (drinking water)
  - Environment (crowded living conditions)
- Use in health epidemics
  - Smoking
  - Cervical cancer
  - Coronary heart disease
  - Obesity

Figure 4. Epidemiological Triad



In its classic use, epidemiology considers the interaction of three factors in the development of disease: the *host*, the *agent*, and the *environment*, which is called the Epidemiological Triad.

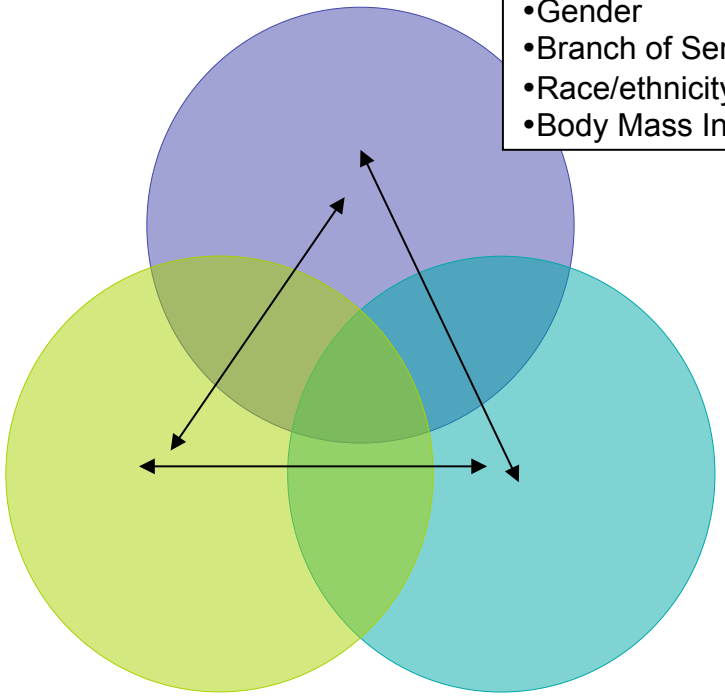
Body Mass Index (BMI) and the Epidemiological Triad



Body Mass Index (BMI) and the Epidemiological Triad

HOST

Variables
- Age
- Gender
- Branch of Service
- Race/ethnicity
- Body Mass Index



AGENT

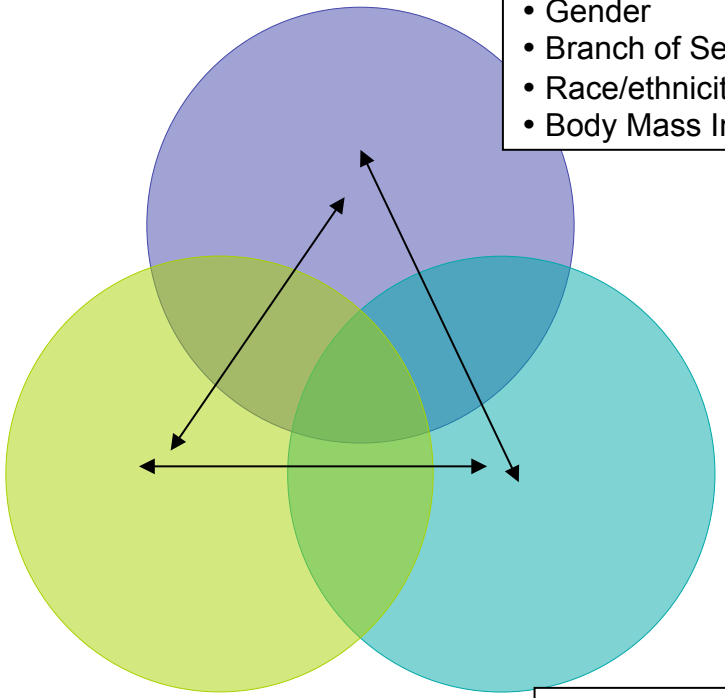
ENVIRONMENT

Variable
- Vigorous physical activity (PA)

Body Mass Index (BMI) and the Epidemiological Triad

HOST

Variables
- Age
- Gender
- Branch of Service
- Race/ethnicity
- Body Mass Index



AGENT

Variable
- Vigorous physical activity (PA)

ENVIRONMENT

Variable
- Mandatory physical fitness standards

Federal Relevance

- Despite high rates of self-reported vigorous exercise, the military is still far from meeting the *HP 2010* Healthy Weight objective.
- Active duty military personnel are at increased risk for disease co-morbidities related to being overweight
- Military operational readiness potentially threatened

Primary data set: 2005 SHRB

- Overview of SHRB primary study
  - Cross-sectional survey
  - Comprehensive sampling plan
  - Data collection & analysis for pilot & main field tests
  - Represents military service members from all branches worldwide (stratified for each service)
  - Tracks *HP 2000 & 2010* objectives
  - Two-person teams conduct survey sessions at 60+ large installations
    - Randomly identified military personnel
    - Anonymous, self-administered questionnaire
  - Overall response rate 51.6%, consistent since 1998
  - 600+ variables

Secondary study

- Secondary Data Analysis, descriptive design
  - Organized data analysis plan (Avoids “fishing”)
    - Data subset created
      - Applied inclusion criteria (age 20-45)
      - Clean & scrub data
      - Code & label variables
    - Preliminary analysis
      - Frequencies
      - Identification of outliers
      - Missing data
    - Descriptive statistics
    - Inferential statistics
      - One-way ANOVA
      - T-tests of independent groups

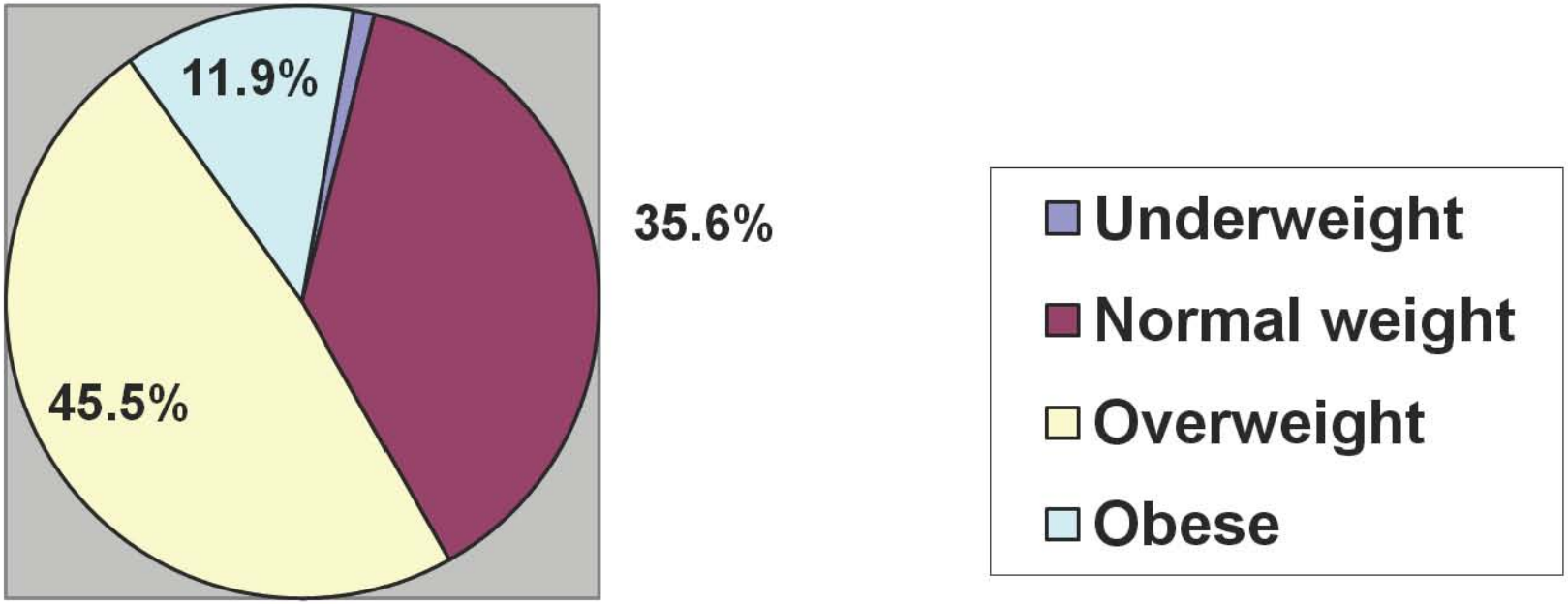
Main variables

- BMI
  - Calculated variable (weight-kg/height-m2)
    - Self-reported height and weight variables
- Vigorous PA
  - Transformed 3 variables
    - PA occurrence (yes/no dichotomous)
    - PA days per week (nominal)
    - PA minutes per session (nominal)
      - Result: one variable with three levels

Sample

- N = 14,852
- Ages 20-45
- Mean age = 30.6 years
- Males, 75.3%; females 24.7%
- Race/ethnicity
  - 62.7% Caucasian
  - 16.9% African American
  - 14.5% Other
  - 4% Asian

Weight Group Based on CDC Classification



Results (ANOVA)

- BMI
  - Personnel who met recommendations for vigorous PA
    - Mean = 25.97
      - 95% CI: 25.8, 26.0
  - Personnel who had insufficient vigorous PA to meet recommendations
    - Mean = 25.98
      - 95% CI: 25.90, 26.07
  - Personnel who had no vigorous PA
    - Mean = 25.95
      - 95% CI: 25.8, 26.1

ANOVA Summary Table for BMI by Vigorous PA Group

Source	df	Sum of Squares	Mean Square	F	Significance
Between Groups	2	2.733	1.366	.104	.901
Within Groups	13,782	180455.13	13.094		
Total	13,784	180457.87			

Results

- There was no significant difference in the BMI means between the three groups
  - Met vigorous PA recommendations group
  - Insufficient vigorous PA group
  - No vigorous PA group
- p = .911

Results

- BMI
  - Personnel who passed a recent physical fitness test
    - Mean = 25.7
      - SD = 3.38
  - Personnel who did not pass a recent physical fitness test
    - Mean = 28.9
      - SD = 4.6
  - -t-test (889.13) = - 19.25, p = 000
  - d = 1.29, effect size r = 0.54

Limitations

- Missing data
  - Investigate patterns
  - Well-established survey, minimal problem
- Statistical significance
  - High likelihood based on sample size alone
  - ? Clinical significance
  - Calculate effect size & Cohen's *d*
- External validity
  - Complex sampling designs
  - Weighted variables
- Bias
  - Self-reported measurement of BMI & PA frequencies

Implications

- Military exist in unique culture
  - Shielded from US overweight trend?
  - Seldom included in US surveys
- Multiple causes of increased BMI in military
  - Future studies
    - Explore how vigorous PA and unique aspects of the military environment affect BMI
      - Physical fitness testing
      - Deployment readiness
      - Access to health care

Conclusions

- Military population affected by national overweight trends *despite* emphasis on vigorous PA
  - Benefits of PA occur in absence of weight loss
    - Reality: Weight standards exist in military culture
- Physical fitness testing may have beneficial impact on members' BMI
  - Fitness policies continuously redefined & improved in each service
  - Trend analysis for future studies

THANK YOU FOR YOUR ATTENTION!

QUESTIONS?

USU Research Week - Poster presentation
May 12, 2008

THE RELATIONSHIP BETWEEN BODY MASS INDEX AND VIGOROUS PHYSICAL ACTIVITY IN AN ACTIVE DUTY MILITARY POPULATION

Julie M. Bosch, Lt Col, USAF, NC; Diane L. Padden, PhD, CRNP; & Sandra C. Bibb, DNSc., CAPT, USN (ret)
Graduate School of Nursing, Uniformed Services University of the Health Sciences

BACKGROUND & PROBLEM

- Physical fitness of service members is an important attribute that directly influences the effectiveness of the military organization and the outcomes of the mission.
- Each branch of the armed forces has unique standards for physical fitness and weight standards, as well as programs and policies to ensure compliance with these standards.
- Despite high rates of vigorous physical activity (PA), the military is far from meeting the *Healthy People 2010* objective that "60% of adults 20 years and older will have a healthy weight".

OBJECTIVES

- Investigate the relationship between body mass index (BMI) and vigorous physical activity (PA) among military members.
- Describe the relationship between BMI and mandatory physical fitness standards.

THEORETICAL FRAMEWORK

- Epidemiological Triad Model, originally used to address infectious disease epidemics, but noncommunicable diseases have also benefited from this innovative approach.
- Offers a unique view, not solely from an individual perspective, but an epidemiological standpoint better suited to develop future population health intervention programs.

Research sponsored by the Graduate School of Nursing, Uniformed Services University. The views expressed in this poster are those of the researchers and do not necessarily reflect those of the Uniformed Services University, the Department of Defense, or the US Government.

Epidemiological Triad Model

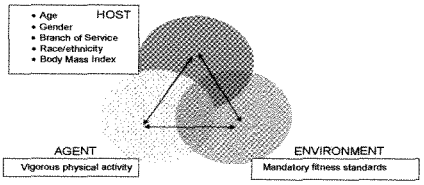


TABLE 1 Mean BMI by Vigorous PA Group

Vigorous PA Groups	N	Mean BMI	SD
Met vigorous PA recommendations	4,633	25.97	3.46
Insufficient vigorous PA	6,394	25.98	3.55
No vigorous PA	2,758	25.95	4.00

TABLE 2 ANOVA Summary Table for BMI by Vigorous PA Group

Source	df	Sum of Squares	Mean Square	F	Significance
Between Groups	2	2.733	1.366	.104	**.901**
Within Groups	13,782	180455.13	13.094		
Total	13,784	180457.87			

RESULTS

There was a significant difference between the mean BMI of members who passed a recent physical fitness test (M= 25.7, SD = 3.38), and those who did not [M = 28.9, SD = 4.6, t (889.13) = -19.25, p =.000]. The magnitude of the difference was medium (*d* = 1.29, effect size *r* = 0.54).

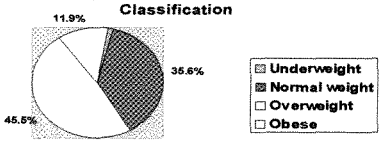
RESEARCH DESIGN AND METHODS

- Descriptive design
- Secondary Data Analysis using well-established DoD dataset
- Survey of Health Related Behaviors among Military Personnel (2005)

STATISTICAL ANALYSIS

- BMI (weight-kg/height-m2) calculated from self-reported height and weight.
- A new vigorous PA variable was created by transforming three variables (PA occurrence, PA days per week, and PA minutes per session) into one variable with three levels.
- Sample of adults 20 to 45 years of age (N = 14, 852)

Weight Group Based on CDC Classification



IMPLICATIONS FOR NURSING

- Active duty military personnel at increased risk for disease co-morbidities related to being overweight.
- Future studies should explore how vigorous PA and mandatory physical fitness standards affect BMI.

THE RELATIONSHIP BETWEEN BODY MASS INDEX AND VIGOROUS PHYSICAL ACTIVITY IN AN ACTIVE DUTY MILITARY POPULATION

Julie M. Bosch, Lt Col, USAF, NC; Diane L. Padden, PhD, CRNP; Tracy Sbrocco, PhD; & Sandra C. Bibb, DNSc., CAPT, USN (ret)

Graduate School of Nursing, Uniformed Services University of the Health Sciences

BACKGROUND & PROBLEM

- Individual soldier combat readiness through enhanced physical fitness is emphasized in the U.S. military
- Physical fitness of service members is an important attribute that directly influences the effectiveness of the military organization and the outcomes of the mission.
- Each branch of the armed forces has unique standards for physical fitness and weight standards, as well as programs and policies to ensure compliance with these standards.
- Despite high rates of vigorous physical activity (PA), the military is far from meeting the *Healthy People 2010* objective that "60% of adults 20 years and older will have a healthy weight".

OBJECTIVES

- Investigate the relationship between body mass index (BMI) and vigorous physical activity (PA) among military members.
- Describe the relationship between BMI and mandatory physical fitness standards.

THEORETICAL FRAMEWORK

- Epidemiological Triad Model, originally used to address infectious disease epidemics, but noncommunicable diseases have also benefited from this innovative approach.
- Moves research focus from traditional biomedical paradigm and examines it in a broader scope.
- Offers a unique view, not solely from an individual perspective, but an epidemiological standpoint better suited to develop future population health intervention programs.

Research sponsored by the Graduate School of Nursing, Uniformed Services University. The views expressed in this poster are those of the researchers and do not necessarily reflect those of the Uniformed Services University, the Department of Defense, or the US Government.

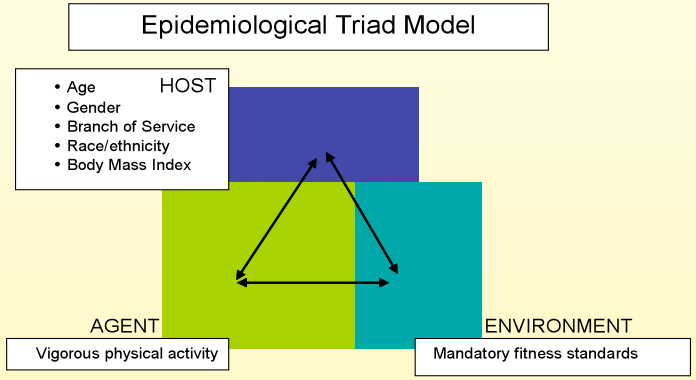


TABLE 1 **Mean BMI by Vigorous PA Group**

Vigorous PA Groups	N	Mean BMI	SD
Met vigorous PA recommendations	4,633	25.97	3.46
Insufficient vigorous PA	6,394	25.98	3.55
No vigorous PA	2,758	25.95	4.00

TABLE 2 **ANOVA Summary Table for BMI by Vigorous PA Group**

Source	df	Sum of Squares	Mean Square	F	Significance
Between Groups	2	2.733	1.366	.104	**.901**
Within Groups	13,782	180455.13	13.094		
Total	13,784	180457.87			

RESULTS

Mean BMI of personnel who met recommendations for vigorous PA was 25.97 (95% CI: 25.8, 26.0), insufficient vigorous PA 25.98 (95% CI: 25.90, 26.07) and no vigorous PA 25.95 (95% CI: 25.8, 26.1). There was no significant difference (p = .901).

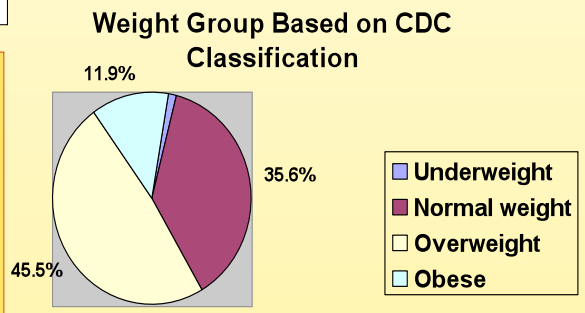
However, there was a significant difference between the mean BMI of members who passed their recent physical fitness test (M= 25.7, SD=3.38), and those who did not [M=28.9, SD=4.6, t (889.13) =-19.25, p=.000]. The magnitude of the difference was medium (*d* = 1.29, effect size *r* = 0.54).

RESEARCH DESIGN AND METHODS

- Descriptive design
- Secondary Data Analysis using well-established DoD dataset
- Survey of Health Related Behaviors among Military Personnel (2005)

STATISTICAL ANALYSIS

- BMI (weight-kg/height-m2) calculated from self-reported height and weight.
- A vigorous PA variable was created by transforming three variables (PA occurrence, PA days per week, and PA minutes per session) into one variable with three levels.
- Sample of adults 20 to 45 years of age (N = 14, 852)



IMPLICATIONS FOR NURSING

- Active duty military personnel at increased risk for disease co-morbidities related to being overweight.
- Future studies should explore how vigorous PA and mandatory physical fitness standards affect BMI.
- Nurses can design future interventional studies customized to unique needs of the military member.

RESEARCH WEEK 2008
May 12–14

CELEBRATING EXCELLENCE IN RESEARCH

The Plenary Lecture:

John I. Gallin, M.D.

"Opportunities and Challenges for Translating Basic Research into Clinical Practice"

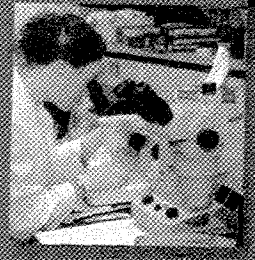
Wednesday, May 14th

The Bullard Lecture:

Anthony R. Means, Ph.D.

"Ca^{2+}/Calmodulin Dependent Protein Kinase Kinase 2 (CaMMK2), the Hypothalmic Regulation of Energy Balance and the Metabolic Syndrome"

Tuesday, May 13th



Poster 187

The Relationship Between Body Mass Index and Vigorous Physical Activity in an Active Duty Military Population

Julie M. Bosch, Lt Col, USAF, NC[1], Diane Padden, PhD, CRNP[2], Tracy Sbrocco, PhD[3], Sandra Bibb, DNSc, RN[4]
[1]Graduate School of Nursing, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20814, [2]Assistant Professor; Chair, Department of Health, Injury, and Disease Management, Graduate School of Nursing, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20814-4799, [3]Associate Professor, Director of Research, USU Center for Health Disparities, Dept of Medical & Clinical Psychology, Uniformed Services University, 4301 Jones Bridge Rd.,Bethesda, MD 20814-4799 [4]Associate Professor; Chair, Department of Health Systems, Risk and Contingency Management, Graduate School of Nursing,Uniformed Services University of the Health Sciences, 4301 Jones Bridge Rd.,Bethesda, MD 20814-4799

Presenting Author: Julie M. Bosch, Lt Col, USAF, NC

Background: Despite high rates of vigorous exercise, the military is far from meeting the *Healthy People 2010* objective that 60% of adults 20 + years or older will have a healthy weight.
Purpose: To investigate the relationship between body mass index (BMI) and vigorous physical activity (PA) among active duty military members.
Design and Methods: Secondary data analysis using the 2005 Survey of Health Related Behaviors among Military Personnel to obtain a sample of adults 20 to 45 years of age (N=14,852). BMI (weight-kg/height-m2) was calculated from self-reported height and weight. A vigorous PA variable was created by transforming three variables (PA occurrence, days per week, and minutes per session) into one variable with three levels. Descriptive statistics (Mean, SD, CI) One-way ANOVA and t-tests of independent groups were used to conduct analyses.
Results: Mean BMI of personnel who met recommendations for vigorous PA was 25.97 (95% CI: 25.8, 26.0), insufficient PA 25.98 (95% CI: 25.90, 26.07) and no vigorous PA 25.95 (95% CI: 25.8, 26.1). There was no significant difference (p = .911). There was a significant difference between the BMI of members who passed a recent physical fitness test (M= 25.7, SD=3.38), and those who did not [M=28.9, SD=4.6, t (889.13) =-19.25, p=.000]. The magnitude of the difference was large (d = 1.29, effect size r = 0.54).
Implications: The mean BMI in all categories was overweight by the National Heart, Lung, and Blood Institute guidelines. Future studies should explore how vigorous PA and unique aspects of the military environment affect BMI.
Research Support Source: Uniformed Services University, Office of Research

Poster 188

Characteristics of Military Service Members Who Intend to Quit Smoking

MAJ Jane Christensen[1], Capt Suann Davison[2], Capt Lisa A. Ware[3]
[1,2,3]Graduate School of Nursing, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, Md 20814-4799

Presenting Author: Lisa Ware

Problem: The Survey of Health Related Behaviors (SHRB) tracks progress of United States (US) military personnel towards goals set by the current US health initiative. Increasing costs from tobacco use on society has led many to examine military cigarette use but limited information exists describing characteristics of military personnel who smoke with intentions to quit.
Purpose: The purpose was to identify and describe demographic characteristics of active duty military personnel who currently smoke cigarettes and have intention to quit.
Design and Methods: A descriptive study was conducted using secondary analysis of data from the 2005 SHRB. Specific demographic characteristics of active duty military smokers (n=4505) were extracted and analyzed. Descriptive statistics were used to describe and summarize identified characteristics. Independent samples chi-square analysis was used to examine differences in intention to quit smoking and several demographic characteristics.
Results: Army members, enlisted soldiers E1-E3, and officers from all services smoke the most and have the least intention to quit. Air Force members, enlisted E-7-E-9, and warrant officers from every service and African

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
F. EDWARD HEBERT SCHOOL OF MEDICINE
4301 JONES BRIDGE ROAD
BETHESDA, MARYLAND 20814-4799

Notice of Fund Approval
Change Number: Original

Project Number: T061IQ-01
Principal Investigator: Julie M. Bosch
Department: GSN-Graduate School of Nursing
Sponsor: Uniformed Services University of the Health Sciences
Project Type: USUHS/Graduate Student
Title: Epidemiologic Factors Related to Increased Body Mass Index in Active Duty Military Engaged in Vigorous Physical Activity

Project Period: 11/01/2007 - 09/30/2008
Budget Period: 11/01/2007 - 09/30/2008

Budget Category	Budgeted Amount
Personnel:	$0
Travel:	$
Supplies/Other Expenses:	$2,500
Equipment:	$0
Grants/Stipends:	$0
Support Cost Recovery:	$0
Total:	$2,500

Remarks:
Funding is contingent upon the availability of funds.

This Notice of Fund Approval represents your award in the amount of $2,500 loaded in the supply/other category. All Funds must be spent by September 30, 2008. Upon completion of this project, a final progress report must be submitted to the Office of Research.

Questions regarding this award should be directed to Sharon McIver at 301- 295-9814 in the Office of Research.

for Mary Kay Gibbons 11/28/07
Toya V. Randolph, PhD, MSPH
Director, Research Development Office
Uniformed Services University of the Health Sciences

Date Funding Accomplished: 11/28/2007 Budget Officer: Verna M. Hill

cc: Shohreh Razi
Mary Kay Gibbons
Sandra Garmon-Bibb